

# ELITE IGCSE ACADEMY

*Excellence in Mathematics Education*

EDEXCEL IGCSE MATHEMATICS A (4MA1)

## Higher Tier Expertise Classified Problems (Q20+)

40 Past Papers ▪ 214 Questions ▪ 58 Topics ▪ 6 Units

PREPARED & CLASSIFIED BY

**Dr. Eslam Ahmed**

*Founder & Lead Instructor*

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## Unit I

# Numbers & the Number System

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Dr. Eslam Ahmed

## Topic 1

# Number Toolkit

---

### Numbers & the Number System

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 2

# Set Notation & Venn Diagrams

---

### Numbers & the Number System

1 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2024

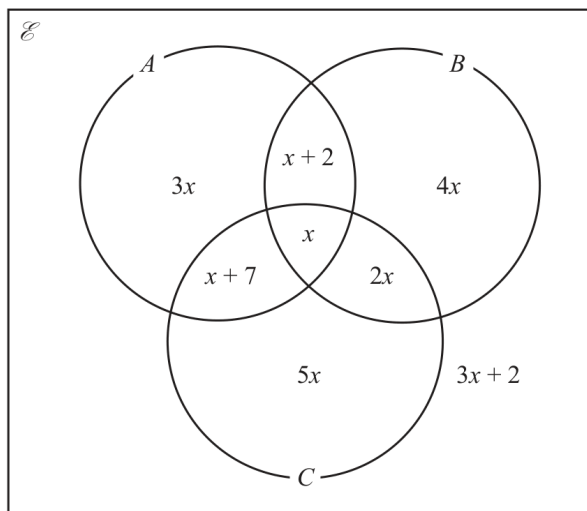
Q#: 21

Marks: 4

TOPIC: Set Notation & Venn Diagrams

Source: Nov 2024 P2H | PDF pages: 21-21

- 21 The Venn diagram shows information about the numbers of items in set  $A$ , set  $B$  and set  $C$ , where  $x$  is an integer.



Given that  $n(A \cup B)' = 26$

find  $n(A' \cap C)$

$n(A' \cap C) = \dots\dots\dots$

(Total for Question 21 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

### Topic 3

# Prime Factors, HCF & LCM

---

#### Numbers & the Number System

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 4

# Powers, Roots & Standard Form

---

### Numbers & the Number System

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 5

# Fractions

---

### Numbers & the Number System

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 6

# Percentages

---

### Numbers & the Number System

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 7

# Compound Interest & Depreciation

---

### Numbers & the Number System

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 8

# Fractions, Decimals & Percentages

---

### Numbers & the Number System

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 9

# Rounding, Estimation & Bounds

---

### Numbers & the Number System

6 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May 2021

Q#: 20

Marks: 3

TOPIC: Rounding, Estimation &amp; Bounds

Source: May 2021 P1H | PDF pages: 19-19

$$20 \quad P = \frac{t - w}{y}$$

 $t = 9.7$  correct to 1 decimal place $w = 5.9$  correct to 1 decimal place $y = 3$  correct to 1 significant figure

Calculate the upper bound for the value of  $P$ .  
Show your working clearly.

---

(Total for Question 20 is 3 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1HR

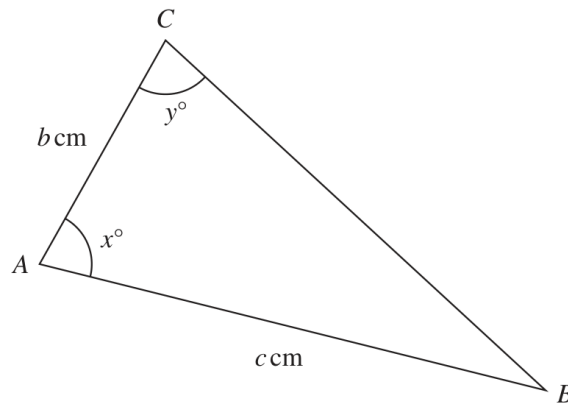
Session: Jan 2022

Q#: 22

Marks: 4

TOPIC: Rounding, Estimation &amp; Bounds

Source: Jan 2022 P1HR | PDF pages: 27-27

22 The diagram shows triangle  $ABC$ Diagram **NOT**  
accurately drawn

$$\begin{aligned} c &= 11.5 \quad \text{correct to one decimal place} \\ x &= 80 \quad \text{correct to the nearest whole number} \\ y &= 75 \quad \text{correct to the nearest whole number} \end{aligned}$$

Calculate the upper bound for the value of  $b$   
 Show your working clearly.  
 Give your answer correct to 3 significant figures.

.....  
 (Total for Question 22 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2023

Q#: 25

Marks: 4

TOPIC: Rounding, Estimation &amp; Bounds

Source: Jun 2023 P2H | PDF pages: 28-28

- 25 A solid sphere has a radius of 2.8 centimetres, correct to 1 decimal place.  
The sphere has a mass of  $M\pi$  grams, where  $M = 260$  correct to 2 significant figures.
- Work out the upper bound for the density of the sphere.  
Give your answer in  $\text{g/cm}^3$  correct to 2 decimal places.  
Show your working clearly.

.....  $\text{g/cm}^3$ **(Total for Question 25 is 4 marks)****WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2024

Q#: 21

Marks: 3

TOPIC: Rounding, Estimation &amp; Bounds

Source: Nov 2024 P1H | PDF pages: 22-22

$$21 \quad T = \frac{x^2 + y^2}{w}$$

 $x = 28.4$  correct to 1 decimal place. $y = 17$  correct to 2 significant figures. $w = 90$  correct to the nearest 5Calculate the upper bound for the value of  $T$ Give your answer correct to 3 significant figures.  
Show your working clearly.

.....  
(Total for Question 21 is 3 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

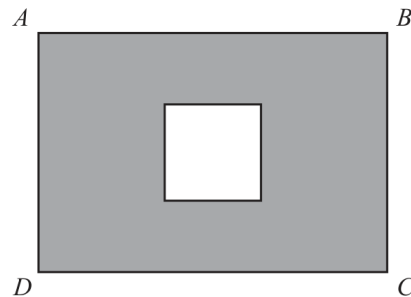
Session: Jun 2025

Q#: 22

Marks: 4

TOPIC: Rounding, Estimation &amp; Bounds

Source: Jun 2025 P2H | PDF pages: 20-20

22 The diagram shows a square inside rectangle  $ABCD$ Diagram NOT  
accurately drawnThe total area of the region shown shaded in the diagram is  $X \text{ cm}^2$  $AB = 11.5 \text{ cm}$  correct to the nearest  $0.5 \text{ cm}$  $BC = 9.2 \text{ cm}$  correct to 2 significant figuresside of square =  $4.1 \text{ cm}$  correct to 2 significant figuresBy considering bounds, work out the value of  $X$  to a suitable degree of accuracy.  
Show your working clearly. $X = \dots\dots\dots$ 

(Total for Question 22 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2025

Q#: 24

Marks: 5

TOPIC: **Rounding, Estimation & Bounds**

Source: Nov 2025 P2H | PDF pages: 24-24

$$24 \quad D = \frac{n}{p - q}$$

 $n = 10.3$  correct to 1 decimal place $p = 7.24$  correct to 2 decimal places $q = 4.39$  correct to 2 decimal places

By considering bounds, work out the value of  $D$  to a suitable degree of accuracy.

Show your working clearly.

.....  
(Total for Question 24 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

## Topic 10

# Surds

---

### Numbers & the Number System

3 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2020

Q#: 20

Marks: 3

TOPIC: **Surds**

Source: Jan 2020 P2H | PDF pages: 20-20

**20** The area of a rectangle is  $18 \text{ cm}^2$

The length of the rectangle is  $(\sqrt{7} + 1) \text{ cm}$ .

Without using a calculator and showing each stage of your working,

find the width of the rectangle.

Give your answer in the form  $a\sqrt{b} + c$  where  $a$ ,  $b$  and  $c$  are integers.

..... cm

**(Total for Question 20 is 3 marks)**

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jun 2022

Q#: 21

Marks: 4

TOPIC: **Surds**

Source: Jun 2022 P1HR | PDF pages: 23-23

21 Express  $\frac{3 + \sqrt{8}}{(\sqrt{2} - 1)^2}$  in the form  $p + \sqrt{q}$  where  $p$  and  $q$  are integers.

Show each stage of your working clearly.

.....  
(Total for Question 21 is 4 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2023

Q#: 23

Marks: 4

TOPIC: **Surds**

Source: Jun 2023 P2H | PDF pages: 24-25

23 The diagram shows a cuboid with a square cross section.

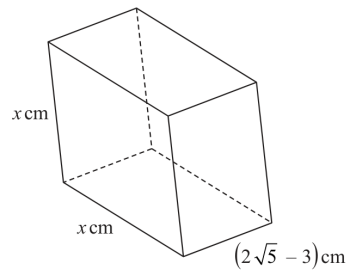


Diagram **NOT**  
accurately drawn

The volume of the cuboid is  $(13 + 6\sqrt{5})\text{cm}^3$

Without using a calculator, find the value of  $x$   
Give your answer in the form  $a + \sqrt{b}$  where  $a$  and  $b$  are integers.  
Show your working clearly.

$x = \dots\dots\dots$

(Total for Question 23 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

## Topic 11

# Using a Calculator

---

### Numbers & the Number System

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

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## Topic 12

# Ratio Toolkit

---

### Numbers & the Number System

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

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## Topic 13

# Ratio Problem Solving

---

### Numbers & the Number System

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 14

# Exchange Rates & Best Buys

---

### Numbers & the Number System

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

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## Topic 15

# Direct & Inverse Proportion

---

### Numbers & the Number System

1 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jan 2022

Q#: 20

Marks: 4

TOPIC: **Direct & Inverse Proportion**

Source: Jan 2022 P2HR | PDF pages: 25-25

20  $y$  is inversely proportional to  $\sqrt{x}$   
 $x$  is directly proportional to  $T^3$

Given that  $y = 8$  when  $T = 25$

find the exact value of  $T$  when  $y = 27$

$T = \dots\dots\dots$

**(Total for Question 20 is 4 marks)**

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

## Unit II

# Equations, Formulae & Identities

---

Dr. Eslam Ahmed

## Topic 16

# Algebra Toolkit

---

### Equations, Formulae & Identities

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 17

# Algebraic Roots & Indices

---

### Equations, Formulae & Identities

5 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jan 2020

Q#: 21

Marks: 7

TOPIC: Algebraic Roots &amp; Indices

Source: Jan 2020 P2HR | PDF pages: 22-22

21 (a) Simplify fully  $\frac{10x^2 + 23x + 12}{4x^2 - 9}$

$$2^{2y} \times 2^{3y+2} = \frac{8^{5y}}{4^n}$$

.....  
(3)

(b) Find an expression for  $n$  in terms of  $y$ .  
Show clear algebraic working and simplify your expression.

.....  
(4)**(Total for Question 21 is 7 marks)****WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: May-Nov 2020

Q#: 21

Marks: 5

TOPIC: Algebraic Roots &amp; Indices

Source: May-Nov 2020 P1HR | PDF pages: 21-21

21 Given that  $M = \frac{18^{4n} \times 2^{3(n^2-6n)} \times 3^{2(1-4n)}}{12^2}$

find the values of  $n$  for which  $M = 2$

.....  
(Total for Question 21 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2022

Q#: 24

Marks: 3

TOPIC: Algebraic Roots &amp; Indices

Source: Jun 2022 P2H | PDF pages: 24-24

24

$$\frac{18 \times (\sqrt{27})^{4n+6}}{6 \times 9^{2n+8}} = 3^x$$

Express  $x$  in terms of  $n$   
Show your working clearly and simplify your expression.

 $x = \dots\dots\dots$ **(Total for Question 24 is 3 marks)****WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: May 2023

Q#: 24

Marks: 5

TOPIC: Algebraic Roots &amp; Indices

Source: May 2023 P1HR | PDF pages: 25-25

**24** Given that

$$2^n = 2^{x^2} \times 16^x \times 8$$

and

$$x > 0$$

find an expression for  $x$  in terms of  $n$   
State any restrictions on  $n$

---

(Total for Question 24 is 5 marks)

---

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2024

Q#: 23

Marks: 3

TOPIC: Algebraic Roots &amp; Indices

Source: Jun 2024 P2H | PDF pages: 23-23

23 Simplify  $\frac{30 \times 25^{2x+1}}{\sqrt{180} \times (\sqrt{5})^{4x+9}}$

Give your answer in the form  $5^w$  where  $w$  is an expression in terms of  $x$   
Show each stage of your working clearly.

.....  
(Total for Question 23 is 3 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

Worked solution by Dr. Eslam Ahmed – forthcoming.

## Topic 18

# Expanding Brackets

---

### Equations, Formulae & Identities

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 19

# Factorising

---

### Equations, Formulae & Identities

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 20

# Completing the Square

---

### Equations, Formulae & Identities

9 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jan 2020

Q#: 23

Marks: 3

TOPIC: **Completing the Square**

Source: Jan 2020 P2HR | PDF pages: 23-23

23 Express  $7 - 12x - 2x^2$  in the form  $a + b(x + c)^2$  where  $a$ ,  $b$  and  $c$  are integers.

.....  
(Total for Question 23 is 3 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: May 2021

Q#: 22

Marks: 4

TOPIC: **Completing the Square**

Source: May 2021 P2H | PDF pages: 25-25

- 22 The curve **S** has equation  $y = f(x)$  where  $f(x) = x^2$   
 The curve **T** has equation  $y = g(x)$  where  $g(x) = 2x^2 - 12x + 13$

By writing  $g(x)$  in the form  $a(x - b)^2 - c$ , where  $a$ ,  $b$  and  $c$  are constants,  
 describe fully a series of transformations that map the curve **S** onto the curve **T**.

.....

.....

.....

**(Total for Question 22 is 4 marks)****WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jan 2022

Q#: 20

Marks: 4

TOPIC: **Completing the Square**

Source: Jan 2022 P1H | PDF pages: 21-21

20 (a) Express  $7 + 12x - 3x^2$  in the form  $a + b(x + c)^2$  where  $a$ ,  $b$  and  $c$  are integers.

.....  
(3)

**C** is the curve with equation  $y = 7 + 12x - 3x^2$   
The point **A** is the maximum point on **C**

(b) Use your answer to part (a) to write down the coordinates of **A**

(....., .....)  
(1)

(Total for Question 20 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jun 2022

Q#: 24

Marks: 4

TOPIC: **Completing the Square**

Source: Jun 2022 P1H | PDF pages: 26-26

24 Express each of  $a$ ,  $b$  and  $c$  in terms of  $q$  so that

$$q + 12x - qx^2$$

can be written as  $a - b(x - c)^2$

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots$$

$$c = \dots\dots\dots$$

(Total for Question 24 is 4 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jun 2022

Q#: 23

Marks: 5

TOPIC: **Completing the Square**

Source: Jun 2022 P1HR | PDF pages: 26-26

23 (a) Express  $2x^2 - 12x + 3$  in the form  $a(x + b)^2 + c$  where  $a$ ,  $b$  and  $c$  are integers.

.....  
(3)

The curve **C** has equation  $y = 2(x + 4)^2 - 12(x + 4) + 3$

The point  $M$  is the minimum point on **C**

(b) Find the coordinates of  $M$

(....., .....)  
(2)

(Total for Question 23 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May 2024

Q#: 25

Marks: 4

TOPIC: **Completing the Square**

Source: May 2024 P1H | PDF pages: 28-28

**25**  $f(x) = 17 - 3x^2 + 12x$

Write  $f(x)$  in the form  $a - b(x - c)^2$  where  $a$ ,  $b$  and  $c$  are constants.

$f(x) = \dots\dots\dots$

**(Total for Question 25 is 4 marks)****WORKED SOLUTION***Dr. Eslam Ahmed**Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: May 2024

Q#: 20

Marks: 5

TOPIC: **Completing the Square**

Source: May 2024 P1HR | PDF pages: 20-20

- 20 (a) Express  $2x^2 - 11x + 9$  in the form  $a(x - b)^2 - c$  where  $a$ ,  $b$  and  $c$  are numbers to be found.

.....  
(3)

The curve  $C$  has equation  $y = 2(x - 3)^2 - 11(x - 3) + 9$

The point  $P$  is the minimum point on  $C$

- (b) Find the coordinates of  $P$

(....., .....)  
(2)

(Total for Question 20 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2025

Q#: 25

Marks: 6

TOPIC: **Completing the Square**

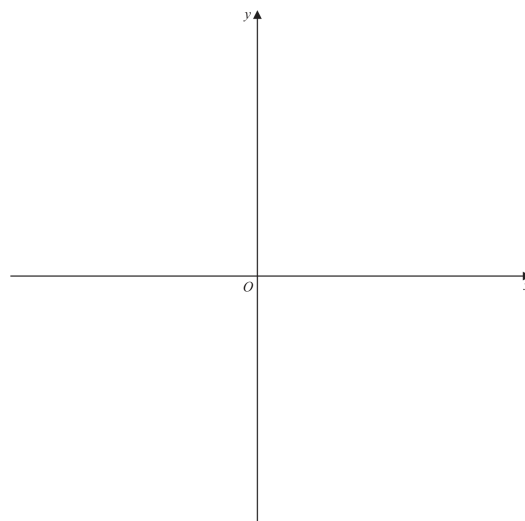
Source: Jun 2025 P2H | PDF pages: 24-25

25 (a) Write  $28 + 24x - 6x^2$  in the form  $a - b(x - c)^2$  where  $a$ ,  $b$  and  $c$  are integers.

(3)

(b) On the axes below, sketch the graph of  $y = 28 + 24x - 6x^2$

Show clearly the coordinates of the turning point and the coordinates of the point of intersection of the graph with the  $y$ -axis.



(3)

(Total for Question 25 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2025

Q#: 21

Marks: 3

TOPIC: **Completing the Square**

Source: Nov 2025 P1H | PDF pages: 17-17

21 Express  $5x^2 - 20x + 23$  in the form  $a(x - b)^2 + c$  where  $a$ ,  $b$  and  $c$  are integers.

.....  
(Total for Question 21 is 3 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

## Topic 21

# Algebraic Fractions

---

### Equations, Formulae & Identities

11 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2020

Q#: 24

Marks: 4

TOPIC: **Algebraic Fractions**

Source: Jan 2020 P2H | PDF pages: 24-24

24 Express

$$\left( \frac{4}{2x-5} - \frac{3}{2x-3} \right) \div \frac{9x-4x^3}{6x^2-17x+5}$$

as a single fraction in its simplest form.

.....

(Total for Question 24 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May-Nov 2020

Q#: 21

Marks: 5

TOPIC: **Algebraic Fractions**

Source: May-Nov 2020 P1H | PDF pages: 23-23

21 Express

$$\frac{1}{3x-2} \times \frac{9x^2-4}{3x^2-13x-10} - \frac{7}{x-1}$$

as a single fraction in its simplest form.

---

(Total for Question 21 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2021

Q#: 21

Marks: 4

TOPIC: **Algebraic Fractions**

Source: Jan 2021 P2H | PDF pages: 24-25

- 21 Write  $\frac{25x^2 - 64}{5x^2 - 13x - 6} \times \frac{x^2 - 8x + 15}{5x + 8} - (x - 7)$   
as a single fraction in its simplest form.  
Show clear algebraic working.

(Total for Question 21 is 4 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May 2021

Q#: 21

Marks: 4

TOPIC: Algebraic Fractions

Source: May 2021 P1H | PDF pages: 20-20

21 Given that  $x = \frac{5}{9y + 5}$  and that  $y = \frac{5}{5a - 2}$

find an expression for  $x$  in terms of  $a$ .

Give your expression as a single fraction in its simplest form.

.....  
(Total for Question 21 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2022

Q#: 23

Marks: 3

TOPIC: Algebraic Fractions

Source: Jun 2022 P2HR | PDF pages: 25-25

23 Express  $\left(\frac{20}{x^2 - 36} - \frac{2}{x - 6}\right) \times \frac{1}{4 - x}$  as a single fraction in its simplest form.

(Total for Question 23 is 3 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

Worked solution by Dr. Eslam Ahmed – forthcoming.

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: May 2023

Q#: 23

Marks: 4

TOPIC: Algebraic Fractions

Source: May 2023 P1HR | PDF pages: 24-24

23 Simplify  $(x^2 - 4) \div \left( \frac{4x^2 - 7x - 2}{x} \right) - 2x$

Give your answer in the form  $\frac{ax^2}{bx + c}$  where  $a$ ,  $b$  and  $c$  are integers.

.....  
(Total for Question 23 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2023

Q#: 24

Marks: 5

TOPIC: **Algebraic Fractions**

Source: Nov 2023 P2H | PDF pages: 24-24

24 Solve  $\frac{45x^2 - 80x}{3x^2 + x - 4} \times \left( \frac{1}{3x - 4} + \frac{1}{x} \right) = \frac{4(x + 2)}{5x - 8}$

Show clear algebraic working.

$$x = \dots\dots\dots$$

**(Total for Question 24 is 5 marks)**

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2024

Q#: 20

Marks: 3

TOPIC: Algebraic Fractions

Source: Jun 2024 P2H | PDF pages: 19-19

20 Given that  $k = x - y$  and  $x = \frac{1}{4y}$

express  $\frac{5k}{x+2}$  in the form  $\frac{a - by^2}{c + dy}$  where  $a, b, c$  and  $d$  are integers.

(Total for Question 20 is 3 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

Worked solution by Dr. Eslam Ahmed – forthcoming.

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2024

Q#: 26

Marks: 4

TOPIC: Algebraic Fractions

Source: Jun 2024 P2HR | PDF pages: 30-30

26 Write  $4 - \left[ (3x - 5) \div \frac{3x^2 + x - 10}{4x - 1} \right]$  as a single fraction in its simplest form.

.....  
(Total for Question 26 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2025

Q#: 23

Marks: 4

TOPIC: Algebraic Fractions

Source: Jun 2025 P2H | PDF pages: 21-21

23  $\frac{4x^2 - 4x - 120}{5x^2 - 180} \div \frac{x^2 + 5x}{10x^2 + 60x} = p$  where  $p$  is an integer.

Find the value of  $p$

Show clear algebraic working.

$$p = \dots\dots\dots$$

(Total for Question 23 is 4 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2025

Q#: 23

Marks: 3

TOPIC: Algebraic Fractions

Source: Nov 2025 P1H | PDF pages: 19-19

$$23 \quad a = \frac{2x+5}{1-x} \quad x = \frac{5-2y}{3y}$$

Write  $a$  in the form  $\frac{m+ny}{p(y-1)}$  where  $m$ ,  $n$  and  $p$  are integers.

Show your working clearly.

$$a = \dots\dots\dots$$

(Total for Question 23 is 3 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

## Topic 22

# Rearranging Formulas

---

### Equations, Formulae & Identities

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 23

# Algebraic Proof

---

### Equations, Formulae & Identities

2 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jan 2020

Q#: 25

Marks: 3

TOPIC: **Algebraic Proof**

Source: Jan 2020 P2HR | PDF pages: 25-25

**25**  $N$  is a multiple of 5

$$A = N + 1$$

$$B = N - 1$$

Prove, using algebra, that  $A^2 - B^2$  is always a multiple of 20

(Total for Question 25 is 3 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2024

Q#: 23

Marks: 4

TOPIC: **Algebraic Proof**

Source: Nov 2024 P2H | PDF pages: 23-23

23 Show that  $\frac{16x^2 - 36}{x - 7} \div \frac{2x^2 + 7x + 6}{x^2 - 5x - 14} - (7 + 8x) = n$

where  $n$  is an integer to be found.  
Show clear algebraic working.

(Total for Question 23 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

## Topic 24

# Solving Linear Equations

---

### Equations, Formulae & Identities

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 25

# Solving Quadratic Equations

---

### Equations, Formulae & Identities

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 26

# Solving Inequalities

---

### Equations, Formulae & Identities

5 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2022

Q#: 22

Marks: 5

TOPIC: Solving Inequalities

Source: Jan 2022 P2H | PDF pages: 24-24

22 Here is a rectangle.

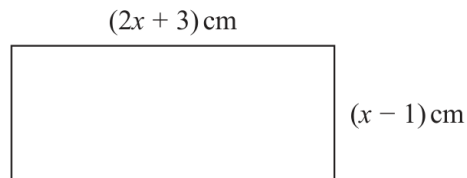


Diagram **NOT**  
accurately drawn

Given that the area of the rectangle is less than  $75\text{ cm}^2$

find the range of possible values of  $x$

.....  
(Total for Question 22 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2024

Q#: 20

Marks: 4

TOPIC: **Solving Inequalities**

Source: Jun 2024 P2HR | PDF pages: 22-22

- 20** Solve  $6x^2 - 7x - 20 > 0$   
Show clear algebraic working.

.....  
**(Total for Question 20 is 4 marks)**

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2024

Q#: 20

Marks: 3

TOPIC: Solving Inequalities

Source: Nov 2024 P2H | PDF pages: 20-20

- 20** Solve the inequality  $10x^2 + 11x - 21 < 0$   
Show clear algebraic working.

.....  
(Total for Question 20 is 3 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2025

Q#: 21

Marks: 3

TOPIC: **Solving Inequalities**

Source: Jun 2025 P2HR | PDF pages: 21-21

**21** Solve the inequality  $2x^2 - 7x - 15 > 0$

Show clear algebraic working.

.....  
(Total for Question 21 is 3 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2025

Q#: 25

Marks: 3

TOPIC: Solving Inequalities

Source: Nov 2025 P1H | PDF pages: 21-21

- 25 Solve the inequality  $2x^2 + x - 28 > 0$   
Show clear algebraic working.

---

(Total for Question 25 is 3 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

## Topic 27

# Simultaneous Equations

---

### Equations, Formulae & Identities

6 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2022

Q#: 21

Marks: 5

TOPIC: **Simultaneous Equations**

Source: Jun 2022 P2HR | PDF pages: 23-23

**21** Solve the simultaneous equations

$$\begin{aligned}x - 2y &= 3 \\ x^2 - y^2 + 2x &= 10\end{aligned}$$

Show clear algebraic working.

.....

**(Total for Question 21 is 5 marks)**

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2023

Q#: 21

Marks: 5

TOPIC: **Simultaneous Equations**

Source: Jun 2023 P2H | PDF pages: 21-21

**21** Solve the simultaneous equations

$$\begin{aligned}2x^2 + 3y^2 &= 11 \\ x &= 3y - 1\end{aligned}$$

Show clear algebraic working.

---

(Total for Question 21 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2024

Q#: 22

Marks: 5

TOPIC: Simultaneous Equations

Source: Jun 2024 P2HR | PDF pages: 24-24

**22** Solve the simultaneous equations

$$x^2 + y^2 = y + 11$$

$$y = 3x - 1$$

Show clear algebraic working.

---

(Total for Question 22 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2024

Q#: 22

Marks: 5

TOPIC: **Simultaneous Equations**

Source: Nov 2024 P2H | PDF pages: 22-22

**22** Solve the simultaneous equations

$$x^2 + y^2 + y = 3$$

$$x + 2 = y$$

Show clear algebraic working.

---

(Total for Question 22 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jun 2025

Q#: 22

Marks: 5

TOPIC: Simultaneous Equations

Source: Jun 2025 P1H | PDF pages: 21-21

**22** Solve the simultaneous equations

$$\begin{aligned}x^2 + 3y + y^2 &= 7 \\ y &= x + 2\end{aligned}$$

Show clear algebraic working.

---

(Total for Question 22 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jun 2025

Q#: 22

Marks: 5

TOPIC: **Simultaneous Equations**

Source: Jun 2025 P1HR | PDF pages: 22-22

**22** Solve the simultaneous equations

$$x^2 + y^2 = 41$$

$$2x + y = 3$$

Show clear algebraic working.

.....

**(Total for Question 22 is 5 marks)**

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

## Topic 28

# Forming & Solving Equations

---

### Equations, Formulae & Identities

1 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2025

Q#: 20

Marks: 3

TOPIC: **Forming & Solving Equations**

Source: Nov 2025 P2H | PDF pages: 20-20

20 Here is a quadratic equation.

$$ax^2 + 4x + c = 0$$

The solutions of this equation are given by  $x = \frac{-4 \pm 2\sqrt{39}}{10}$

Find the value of  $a$  and the value of  $c$   
Show your working clearly.

$a =$  .....

$c =$  .....

(Total for Question 20 is 3 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

Worked solution by Dr. Eslam Ahmed – forthcoming.

## Unit III

# Sequences, Functions & Graphs

---

Dr. Eslam Ahmed

## Topic 29

# Sequences

---

### Sequences, Functions & Graphs

16 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2020

Q#: 25

Marks: 3

TOPIC: Sequences

Source: Jan 2020 P2H | PDF pages: 25-25

**25** Mario is going to save \$50 in the year 2021

He is going to continue to save, up to and including the year 2070, by increasing the amount he saves each year by \$ $k$

Mario will save a total of \$33 125 from 2021 to 2070

Work out the value of  $k$ .

$k = \dots\dots\dots$

**(Total for Question 25 is 3 marks)**

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jan 2020

Q#: 22

Marks: 4

TOPIC: Sequences

Source: Jan 2020 P2HR | PDF pages: 23-23

- 22 The first term of an arithmetic series  $S$  is  $-6$   
The sum of the first 30 terms of  $S$  is 2865  
Find the 9th term of  $S$ .

.....  
(Total for Question 22 is 4 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May-Nov 2020

Q#: 24

Marks: 4

TOPIC: Sequences

Source: May-Nov 2020 P1H | PDF pages: 26-26

24 Here are the first five terms of an arithmetic sequence.

8      15      22      29      36

Work out the sum of all the terms from the 50th term to the 100th term inclusive.

.....  
(Total for Question 24 is 4 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jan 2021

Q#: 24

Marks: 4

TOPIC: Sequences

Source: Jan 2021 P1H | PDF pages: 28-28

24 An arithmetic series has first term  $a$  and common difference  $d$ .

The sum of the first  $2n$  terms of the series is four times the sum of the first  $n$  terms of the series.

Find an expression for  $a$  in terms of  $d$ .  
Show your working clearly.

 $a = \dots\dots\dots$ 

(Total for Question 24 is 4 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jan 2021

Q#: 21

Marks: 6

TOPIC: Sequences

Source: Jan 2021 P1HR | PDF pages: 24-25

- 21 The  $n$ th term of an arithmetic series is  $u_n$  where  $u_n > 0$  for all  $n$   
The sum to  $n$  terms of the series is  $S_n$   
Given that  $u_4 = 6$  and that  $S_{11} = (u_6)^2 + 18$   
find the value of  $u_{20}$

(Total for Question 21 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May 2021

Q#: 23

Marks: 5

TOPIC: Sequences

Source: May 2021 P1H | PDF pages: 22-22

- 23** The sum of the first  $N$  terms of an arithmetic series,  $S$ , is 292  
The 2nd term of  $S$  is 8.5  
The 5th term of  $S$  is 13
- Find the value of  $N$ .  
Show clear algebraic working.

 $N = \dots\dots\dots$ **(Total for Question 23 is 5 marks)****WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2021

Q#: 20

Marks: 5

TOPIC: Sequences

Source: Nov 2021 P2H | PDF pages: 23-23

20 Here are the first four terms of an arithmetic series.

$$k \quad \frac{3k}{4} \quad \frac{k}{2} \quad \frac{k}{4}$$

Given that the 15th term of the series is  $(90 + 2k)$ ,

calculate the sum of the first 30 terms of the series.

.....  
(Total for Question 20 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2022

Q#: 26

Marks: 5

TOPIC: Sequences

Source: Jan 2022 P2H | PDF pages: 28-28

- 26 An arithmetic series has first term  $a$  and common difference  $d$ , where  $d$  is a prime number.

The sum of the first  $n$  terms of the series is  $S_n$  and

$$S_m = 39$$

$$S_{2m} = 320$$

Find the value of  $d$  and the value of  $m$   
Show clear algebraic working.

$$d = \dots\dots\dots$$

$$m = \dots\dots\dots$$

(Total for Question 26 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jun 2022

Q#: 25

Marks: 5

TOPIC: Sequences

Source: Jun 2022 P1HR | PDF pages: 28-28

- 25** The sum of the first 10 terms of an arithmetic series is 4 times the sum of the first 5 terms of the same series.

The 8th term of this series is 45

Find the first term of this series.  
Show clear algebraic working.

.....  
**(Total for Question 25 is 5 marks)**

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May 2023

Q#: 20

Marks: 6

TOPIC: Sequences

Source: May 2023 P1H | PDF pages: 22-23

20 The sum of the first 80 terms of an arithmetic series,  $S$ , is 470

The 75th term of  $S$  is 14.5

The sum of the first  $X$  terms of  $S$  is 171

Work out the value of  $X$

Show your working clearly.

$X = \dots\dots\dots$

(Total for Question 20 is 6 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2023

Q#: 23

Marks: 5

TOPIC: Sequences

Source: Jun 2023 P2HR | PDF pages: 24-24

23 Here are the first three terms of an arithmetic sequence.

$$8p \quad 7p - 3 \quad 4p + 2$$

The sum of the first  $n$  terms of the sequence is  $-1914$

Work out the value of  $n$

Show your working clearly.

$$n = \dots\dots\dots$$

(Total for Question 23 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May 2024

Q#: 24

Marks: 6

TOPIC: Sequences

Source: May 2024 P1H | PDF pages: 26-27

24 A polygon has  $n$  sides, where  $n > 5$

The interior angles of the polygon form an arithmetic sequence.

The smallest angle of the polygon is  $84^\circ$

The common difference of the sequence is  $4^\circ$

Work out the sum of the interior angles of the polygon.

Show clear algebraic working.

(Total for Question 24 is 6 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: May 2024

Q#: 23

Marks: 4

TOPIC: Sequences

Source: May 2024 P1HR | PDF pages: 24-24

23 Here are the first three terms of an arithmetic sequence.

$$(4x-14) , (x+2) , (7x-9)$$

Find, as an integer, the sum of the first 40 terms of the sequence.  
Show clear algebraic working.

.....  
(Total for Question 23 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jun 2025

Q#: 24

Marks: 5

TOPIC: Sequences

Source: Jun 2025 P1H | PDF pages: 24-25

24 An arithmetic series has 30 terms.

The first term is  $a$

The common difference is  $d$

The 20th term is 123

The sum of the 30 terms is 2880

Work out the value of  $a$  and the value of  $d$   
Show clear algebraic working.

$a = \dots\dots\dots$

$d = \dots\dots\dots$

(Total for Question 24 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jun 2025

Q#: 24

Marks: 6

TOPIC: Sequences

Source: Jun 2025 P1HR | PDF pages: 24-25

24 The first 3 terms of an arithmetic series are

$$(2x + 5) \quad (3y - 4) \quad (4x - 2)$$

where  $x$  and  $y$  are constants.

The sum of the first 9 terms of the series is 216

Find the value of  $x$  and the value of  $y$   
Show clear algebraic working.

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots$$

(Total for Question 24 is 6 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2025

Q#: 25

Marks: 5

TOPIC: Sequences

Source: Nov 2025 P2H | PDF pages: 25-25

- 25 The first term of an arithmetic series is 10  
The 20th term of the series is 86
- The sum of the first  $N$  terms of the series is 5194
- Work out the value of  $N$   
Show your working clearly.

 $N = \dots\dots\dots$ **(Total for Question 25 is 5 marks)****WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

# Functions

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## Sequences, Functions & Graphs

6 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jan 2020

Q#: 21

Marks: 5

TOPIC: **Functions**

Source: Jan 2020 P1H | PDF pages: 25-25

21 The functions  $f$  and  $g$  are such that

$$f(x) = x^2 - 2x \qquad g(x) = x + 3$$

The function  $h$  is such that  $h(x) = fg(x)$  for  $x \geq -2$

Express the inverse function  $h^{-1}(x)$  in the form  $h^{-1}(x) = \dots$

$$h^{-1}(x) = \dots\dots\dots$$

**(Total for Question 21 is 5 marks)**

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jan 2021

Q#: 22

Marks: 3

TOPIC: **Functions**

Source: Jan 2021 P1H | PDF pages: 25-25

- 22 The function  $f$  is such that  $f(x) = x^2 - 8x + 5$  where  $x \leq 4$   
Express the inverse function  $f^{-1}$  in the form  $f^{-1}(x) = \dots$

$$f^{-1}(x) = \dots\dots\dots$$

(Total for Question 22 is 3 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May 2021

Q#: 24

Marks: 6

TOPIC: Functions

Source: May 2021 P1H | PDF pages: 23-23

24 The functions  $f$  and  $g$  are defined as

$$f(x) = 5x^2 - 10x + 7 \quad \text{where } x \geq 1$$

$$g(x) = 7x - 6$$

(a) Find  $fg(2)$

.....  
(2)

(b) Express the inverse function  $f^{-1}$  in the form  $f^{-1}(x) = \dots$

$$f^{-1}(x) = \dots\dots\dots$$

(4)

**(Total for Question 24 is 6 marks)**

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2022

Q#: 25

Marks: 5

TOPIC: **Functions**

Source: Jan 2022 P2H | PDF pages: 27-27

25 The function  $g$  is defined as

$$g: x \mapsto 5 + 6x - x^2 \quad \text{with domain } \{x: x \geq 3\}$$

(a) Express the inverse function  $g^{-1}$  in the form  $g^{-1}: x \mapsto \dots$

$$g^{-1}: x \mapsto \dots \dots \dots \quad (4)$$

(b) State the domain of  $g^{-1}$

$$\dots \dots \dots \quad (1)$$

**(Total for Question 25 is 5 marks)**

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jan 2022

Q#: 23

Marks: 4

TOPIC: Functions

Source: Jan 2022 P2HR | PDF pages: 30-30

23 The functions  $f$  and  $g$  are such that

$$f(x) = x + 25 \quad g(x) = x^2 - 12x$$

The function  $h$  is such that  $h(x) = fg(x)$

The domain of  $h$  is  $\{x : x \leq 6\}$

Express the inverse function  $h^{-1}$  in the form  $h^{-1}(x) = \dots$

$$h^{-1}(x) = \dots\dots\dots$$

(Total for Question 23 is 4 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2024

Q#: 25

Marks: 4

TOPIC: **Functions**

Source: Nov 2024 P1H | PDF pages: 28-28

25 The function  $f$  is such that  $f(x) = 2x^2 - 24x + 7$  where  $x \geq 6$

Find the inverse function  $f^{-1}(x)$

$f^{-1}(x) = \dots\dots\dots$

**(Total for Question 25 is 4 marks)**

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

## Topic 31

# Coordinate Geometry

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### Sequences, Functions & Graphs

20 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jan 2020

Q#: 22

Marks: 6

TOPIC: **Coordinate Geometry**

Source: Jan 2020 P1H | PDF pages: 26-27

22 Triangle  $HJK$  is isosceles with  $HJ = HK$  and  $JK = \sqrt{80}$

$H$  is the point with coordinates  $(-4, 1)$

$J$  is the point with coordinates  $(j, 15)$  where  $j < 0$

$K$  is the point with coordinates  $(6, k)$

$M$  is the midpoint of  $JK$ .

The gradient of  $HM$  is 2

Find the value of  $j$  and the value of  $k$ .

$j = \dots\dots\dots$

$k = \dots\dots\dots$

(Total for Question 22 is 6 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2020

Q#: 22

Marks: 5

TOPIC: **Coordinate Geometry**

Source: Jan 2020 P2H | PDF pages: 22-22

- 22 The line with equation  $y = x + 2$  intersects the curve with equation  $x^2 + y^2 - 2y = 24$  at the points  $A$  and  $B$ .

Find the coordinates of  $A$  and  $B$ .  
Show clear algebraic working.

(....., .....) )

(....., .....) )

(Total for Question 22 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jan 2020

Q#: 24

Marks: 5

TOPIC: **Coordinate Geometry**

Source: Jan 2020 P2HR | PDF pages: 24-24

24  $L_1$  and  $L_2$  are two straight lines.

The origin of the coordinate axes is  $O$ .

$L_1$  has equation  $5x + 10y = 8$

$L_2$  is perpendicular to  $L_1$  and passes through the point with coordinates  $(8, 6)$

$L_2$  crosses the  $x$ -axis at the point  $A$ .

$L_2$  intersects the straight line with equation  $x = -3$  at the point  $B$ .

Find the area of triangle  $AOB$ .

Show your working clearly.

.....  
(Total for Question 24 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May-Nov 2020

Q#: 22

Marks: 4

TOPIC: **Coordinate Geometry**

Source: May-Nov 2020 P1H | PDF pages: 24-24

**22**  $ABCD$  is a rhombus.

The diagonals,  $AC$  and  $BD$ , intersect at the point  $M$ .

The coordinates of  $M$  are  $(6, -11)$

The points  $A$  and  $C$  both lie on the line with equation  $2y + 7x = 20$

Find the exact coordinates of the point where the line through  $B$  and  $D$  intersects the  $y$ -axis.

(....., .....) )

(Total for Question 22 is 4 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jan 2021

Q#: 22

Marks: 5

TOPIC: **Coordinate Geometry**

Source: Jan 2021 P1HR | PDF pages: 26-27

22  $ABC$  is an isosceles triangle with  $AB = AC$ .

$B$  is the point with coordinates  $(-1, 5)$

$C$  is the point with coordinates  $(2, 10)$

$M$  is the midpoint of  $BC$ .

Find an equation of the line through the points  $A$  and  $M$ .

Give your answer in the form  $py + qx = r$  where  $p$ ,  $q$  and  $r$  are integers.

(Total for Question 22 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2021

Q#: 20

Marks: 7

TOPIC: **Coordinate Geometry**

Source: Nov 2021 P1H | PDF pages: 24-24

- 20** The straight line **L** passes through point  $A(-6, 2)$  and point  $B(5, 3)$   
The straight line **M** is perpendicular to **L** and passes through the midpoint of  $A$  and  $B$ .  
The line **M** intersects the line  $x = -1$  at point  $C$ .
- Calculate the area of triangle  $ABC$ .

.....  
(Total for Question 20 is 7 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jan 2022

Q#: 22

Marks: 5

TOPIC: **Coordinate Geometry**

Source: Jan 2022 P2HR | PDF pages: 28-29

22  $ABC$  is a triangle in which angle  $ABC = 90^\circ$

$p$  and  $q$  are integers such that

the coordinates of  $A$  are  $(p, 10)$

the coordinates of  $B$  are  $(-1, -5)$

the coordinates of  $C$  are  $(8, q)$

Given that the gradient of  $AC$  is  $-\frac{6}{7}$

work out the value of  $p$  and the value of  $q$

$p = \dots\dots\dots$

$q = \dots\dots\dots$

(Total for Question 22 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2022

Q#: 22

Marks: 7

TOPIC: **Coordinate Geometry**

Source: Jun 2022 P2H | PDF pages: 22-23

22  $ABCD$  is a kite, with diagonals  $AC$  and  $BD$ , drawn on a centimetre square grid, with a scale of 1 cm for 1 unit on each axis.

$A$  is the point with coordinates  $(-3, 4)$

The diagonals of the kite intersect at the point  $M$  with coordinates  $(0, 2)$

Given that  $AB = AD = 6.5$  cm and the  $x$  coordinate of  $B$  is positive,

find the coordinates of the points  $B$  and  $D$ .

(....., .....) )

(....., .....) )

(Total for Question 22 is 7 marks)

.....°

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2022

Q#: 20

Marks: 4

TOPIC: **Coordinate Geometry**

Source: Jun 2022 P2HR | PDF pages: 22-22

**20** The centre  $O$  of a circle has coordinates  $(4, 7)$

The point  $A$ , on the circle, has coordinates  $(6, 11)$  and  $AOP$  is a diameter of the circle.

Find an equation of the tangent to the circle at the point  $P$

.....  
(Total for Question 20 is 4 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2023

Q#: 24

Marks: 6

TOPIC: **Coordinate Geometry**

Source: Jun 2023 P2H | PDF pages: 26-27

24  $ABCD$  is a kite with  $AB = AD$  and  $CB = CD$

$A$  is the point with coordinates  $(-2, 10)$

$B$  is the point with coordinates  $\left(-\frac{27}{5}, 4\right)$

$C$  is the point with coordinates  $(4, -5)$

Work out the coordinates of  $D$

(....., .....) )

(Total for Question 24 is 6 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2023

Q#: 21

Marks: 5

TOPIC: **Coordinate Geometry**

Source: Jun 2023 P2HR | PDF pages: 21-21

21 Work out the coordinates of the points of intersection of

$$y - 2x = 1 \quad \text{and} \quad y^2 + xy = 7$$

Show clear algebraic working.

(....., .....) )

(....., .....) )

**(Total for Question 21 is 5 marks)**

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2023

Q#: 25

Marks: 6

TOPIC: **Coordinate Geometry**

Source: Jun 2023 P2HR | PDF pages: 26-27

- 25 The straight line with equation  $y - 2x = 7$  is the perpendicular bisector of the line  $AB$  where  $A$  is the point with coordinates  $(j, 7)$  and  $B$  is the point with coordinates  $(6, k)$
- Find the coordinates of the midpoint of the line  $AB$   
Show clear algebraic working.

(....., .....) )

(Total for Question 25 is 6 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2023

Q#: 22

Marks: 6

TOPIC: **Coordinate Geometry**

Source: Nov 2023 P1H | PDF pages: 25-25

**22** [In this question 1 cm = 1 unit on the  $x$ -axis and  
1 cm = 1 unit on the  $y$ -axis]

$P$  is a point on a circle with centre  $(0, 0)$   
The coordinates of  $P$  are  $(8, -10)$

The line  $L$  is the tangent to the circle at the point  $P$   
 $L$  crosses the  $x$ -axis at the point  $Q$  and crosses the  $y$ -axis at the point  $R$

Work out the length of  $RQ$   
Give your answer correct to 3 significant figures.

..... cm

**(Total for Question 22 is 6 marks)**

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2023

Q#: 21

Marks: 5

TOPIC: **Coordinate Geometry**

Source: Nov 2023 P2H | PDF pages: 19-19

- 21 The line with equation  $x + 2y = 5$  intersects the curve with equation  $x^2 + 3y^2 = 13$  at the points  $A$  and  $B$

Find the coordinates of  $A$  and the coordinates of  $B$   
Show clear algebraic working.

(....., .....) )

(....., .....) )

**(Total for Question 21 is 5 marks)**

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2024

Q#: 22

Marks: 5

TOPIC: **Coordinate Geometry**

Source: Jun 2024 P2H | PDF pages: 22-22

**22** The straight line **L** has equation  $x + y = 5$

The curve **C** has equation  $2x^2 + 3y^2 = 210$

Find the coordinates of the points where **L** and **C** intersect.  
Show clear algebraic working.

(....., .....) (....., .....)

(Total for Question 22 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2024

Q#: 21

Marks: 4

TOPIC: **Coordinate Geometry**

Source: Jun 2024 P2HR | PDF pages: 23-23

**21**  $ABCD$  is a square.

The point  $A$  has coordinates  $(-5, 2)$

The point  $B$  has coordinates  $(3, 5)$

Find an equation of the line that passes through  $B$  and  $C$

Give your answer in the form  $ax + by + c = 0$  where  $a$ ,  $b$  and  $c$  are integers.

.....  
(Total for Question 21 is 4 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jun 2025

Q#: 25

Marks: 5

TOPIC: **Coordinate Geometry**

Source: Jun 2025 P1H | PDF pages: 26-26

25  $PQRS$  is a square.

$PR$  is a diagonal of the square.

$P$  is the point with coordinates  $(4, 7)$

$R$  is the point with coordinates  $(8, -5)$

Find an equation of the straight line that passes through the points  $Q$  and  $S$

Give your answer in the form  $ay = bx + c$  where  $a$ ,  $b$  and  $c$  are integers.

(Total for Question 25 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2025

Q#: 24

Marks: 6

TOPIC: **Coordinate Geometry**

Source: Jun 2025 P2HR | PDF pages: 24-24

24  $PQ$  is a straight line drawn on a square grid, with a scale of 1 cm for 1 unit on each axis.

$P$  has coordinates  $(-5, a)$  and  $Q$  has coordinates  $(7, 3a)$  where  $a > 0$

The length of  $PQ$  is  $4\sqrt{10}$  cm

Find an equation of the perpendicular bisector of  $PQ$

Give your answer in the form  $y = mx + c$  where  $m$  and  $c$  are integers.

.....  
(Total for Question 24 is 6 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2025

Q#: 20

Marks: 3

TOPIC: **Coordinate Geometry**

Source: Nov 2025 P1H | PDF pages: 16-16

**20** The straight line **L** has equation  $y = 4x + 7$

The straight line **M** is perpendicular to **L** and passes through the point with coordinates (8, 1)

Find an equation for **M**

Give your answer in the form  $y = mx + c$

---

(Total for Question 20 is 3 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2025

Q#: 28

Marks: 6

TOPIC: **Coordinate Geometry**

Source: Nov 2025 P1H | PDF pages: 26-27

28 The curve C has equation  $x^2 + y^2 = d - 11x$  where  $d$  is an integer.  
The line L has equation  $y = 3x + e$  where  $e$  is an integer.

C and L intersect at the point A and at the point B

The coordinates of A are (0.2, 2.6)

Work out the coordinates of B  
Show your working clearly.

(....., .....) )

(Total for Question 28 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

## Topic 32

# Linear Graphs ( $y = mx + c$ )

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### Sequences, Functions & Graphs

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 33

# Graphs of Functions

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### Sequences, Functions & Graphs

7 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jan 2020

Q#: 20

Marks: 4

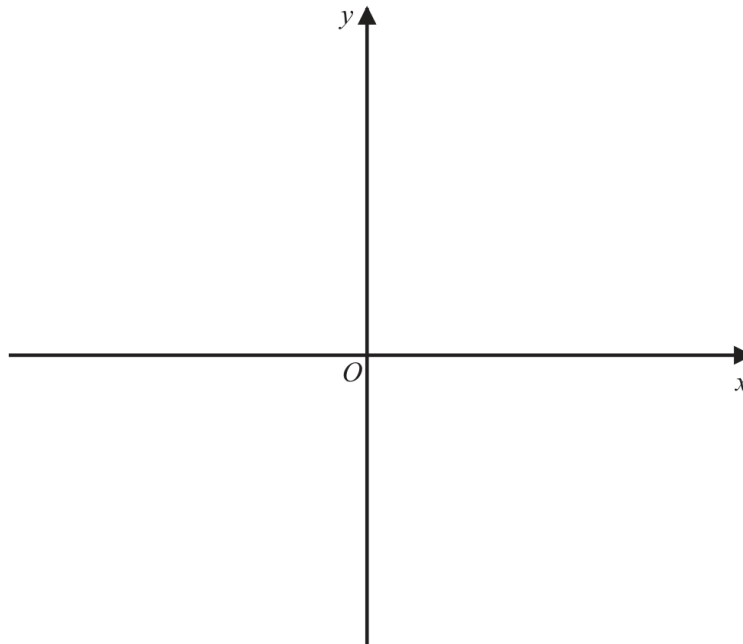
TOPIC: **Graphs of Functions**

Source: Jan 2020 P1H | PDF pages: 24-24

20 The curve **C** has equation  $y = 4(x - 1)^2 - a$  where  $a > 4$

Using the axes below, sketch the curve **C**.  
On your sketch show clearly, in terms of  $a$ ,

- (i) the coordinates of any points of intersection of **C** with the coordinate axes,
- (ii) the coordinates of the turning point.



(Total for Question 20 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2022

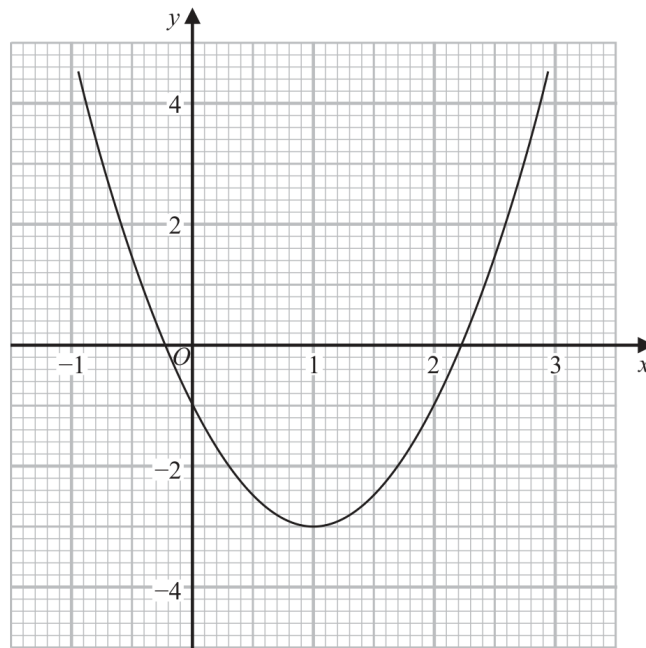
Q#: 21

Marks: 5

TOPIC: Graphs of Functions

Source: Jan 2022 P2H | PDF pages: 23-23

21 Part of the graph of  $y = 2x^2 - 4x - 1$  is shown on the grid.



- (a) Use the graph to find estimates for the solutions of the equation  $2x^2 - 4x - 1 = 0$ .  
Give your solutions correct to one decimal place.

.....  
(2)

- (b) By drawing a suitable straight line on the grid, find estimates for the solutions of the equation  $x^2 - x - 1 = 0$ .  
Show your working clearly.  
Give your solutions correct to one decimal place.

.....  
(3)

(Total for Question 21 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2022

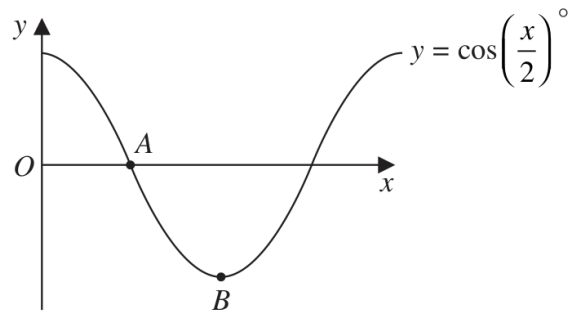
Q#: 23

Marks: 2

TOPIC: Graphs of Functions

Source: Jun 2022 P2H | PDF pages: 23-23

23 The diagram shows a sketch of the graph of  $y = \cos\left(\frac{x}{2}\right)^\circ$



(i) Find the coordinates of the point  $A$

(....., .....)  
(1)

(ii) Find the coordinates of the point  $B$

(....., .....)  
(1)

(Total for Question 23 is 2 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

Worked solution by Dr. Eslam Ahmed – forthcoming.

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2023

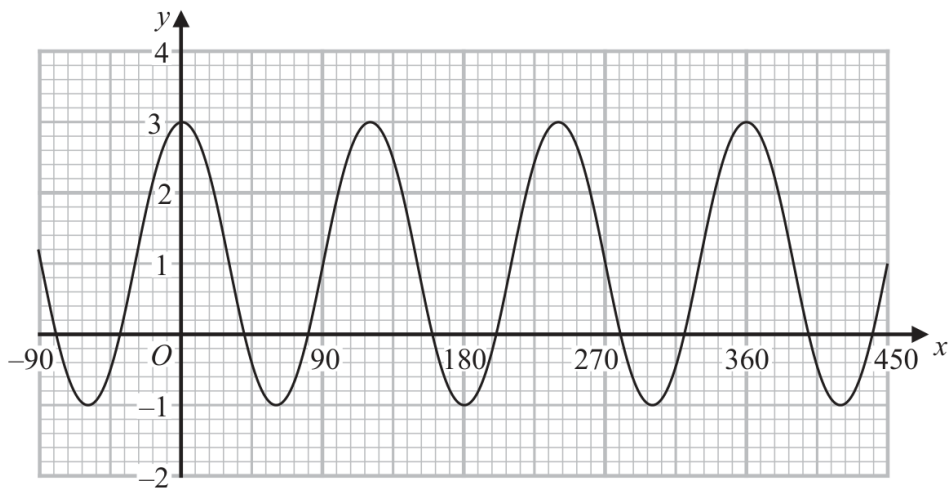
Q#: 26

Marks: 3

TOPIC: Graphs of Functions

Source: Jun 2023 P2HR | PDF pages: 28-28

26 Here is a sketch of the curve with equation  $y = a \cos bx^\circ + c$  where  $-90 \leq x \leq 450$



Find the value of  $a$ , the value of  $b$  and the value of  $c$

$a = \dots\dots\dots$

$b = \dots\dots\dots$

$c = \dots\dots\dots$

**(Total for Question 26 is 3 marks)**

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2024

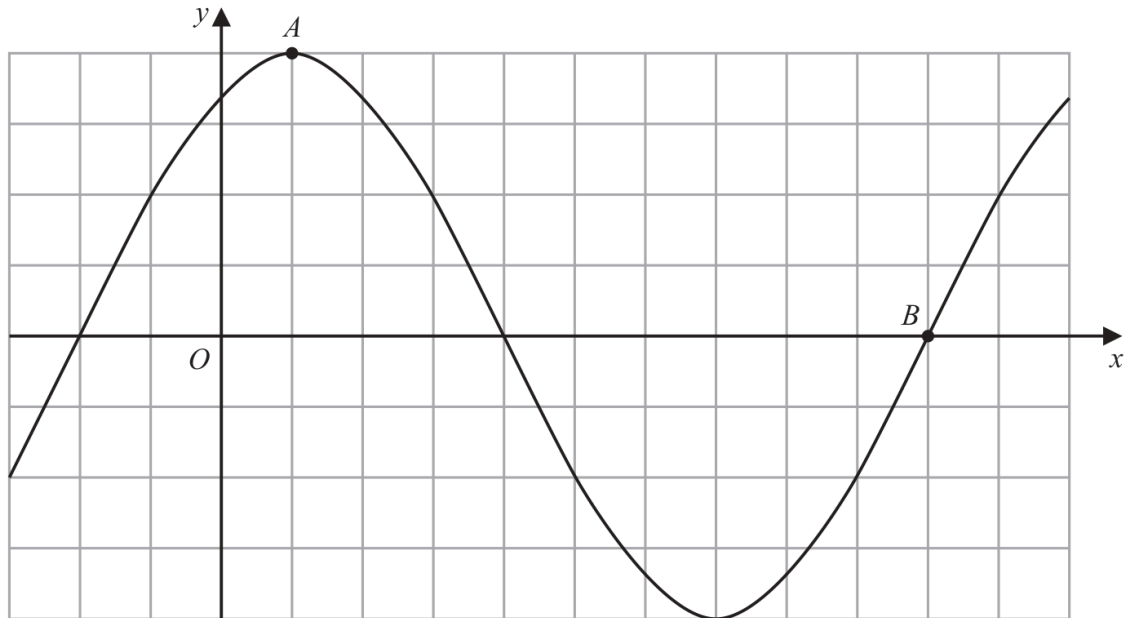
Q#: 25

Marks: 2

TOPIC: Graphs of Functions

Source: Jun 2024 P2H | PDF pages: 26-26

25 The diagram shows a sketch of the graph of  $y = 2\sin(x + 60^\circ)$



(i) Find the coordinates of the point  $A$

(....., .....)  
(1)

(ii) Find the coordinates of the point  $B$

(....., .....)  
(1)

**(Total for Question 25 is 2 marks)**

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2024

Q#: 23

Marks: 5

TOPIC: **Graphs of Functions**

Source: Nov 2024 P1H | PDF pages: 24-25

- 23 The curve C has equation  $y = x^2 - 8x - 9$   
The straight line L has equation  $y = k$  where  $k$  is an integer.

C and L intersect at the points A and B

The coordinates of point A are  $(p, k)$

The coordinates of point B are  $(q, k)$

Given that  $p - q = 14$

find the value of  $k$

Show clear algebraic working.

$k = \dots\dots\dots$

(Total for Question 23 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2025

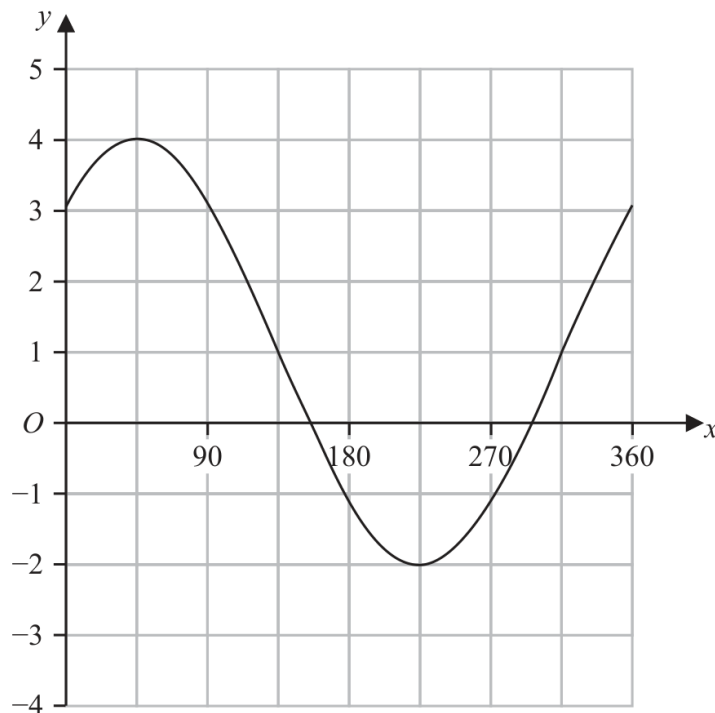
Q#: 25

Marks: 3

TOPIC: Graphs of Functions

Source: Jun 2025 P2HR | PDF pages: 25-25

25 The graph of  $y = a \sin(x + b)^\circ + c$  for  $0 \leq x \leq 360$  is drawn on the grid below.



Find a suitable value for  $a$ , for  $b$  and for  $c$

$a = \dots\dots\dots$   
 $b = \dots\dots\dots$   
 $c = \dots\dots\dots$

**(Total for Question 25 is 3 marks)**

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

## Topic 34

# Estimating Gradients

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### Sequences, Functions & Graphs

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 35

# Real-Life Graphs

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### Sequences, Functions & Graphs

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 36

# Graphing Inequalities

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### Sequences, Functions & Graphs

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

# Transformations of Graphs

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## Sequences, Functions & Graphs

17 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jan 2020

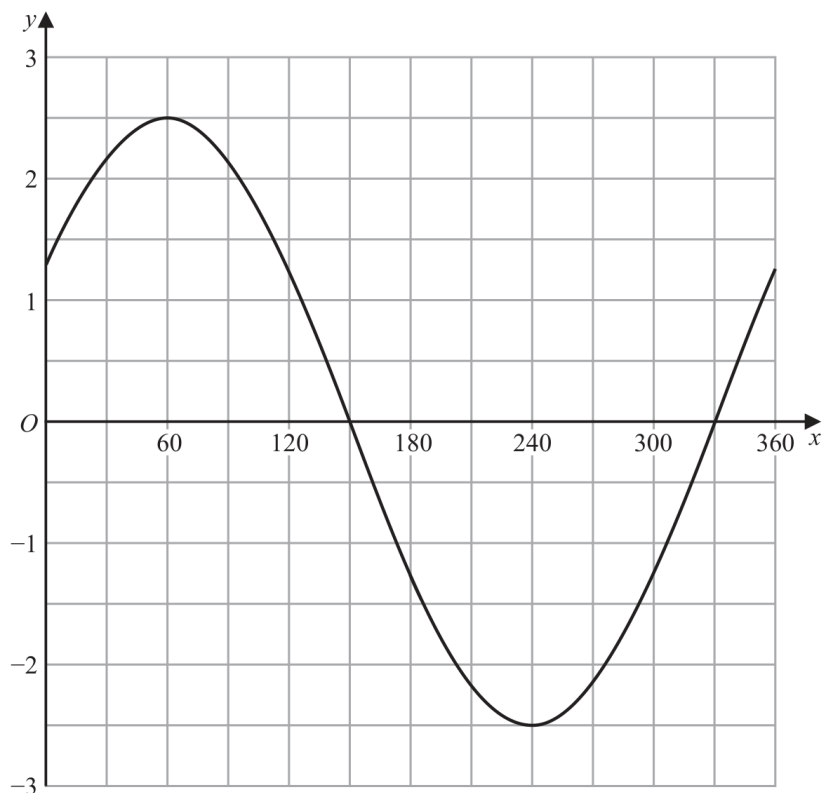
Q#: 22

Marks: 4

TOPIC: Transformations of Graphs

Source: Jan 2020 P1HR | PDF pages: 23-23

22 The graph of  $y = a \cos(x + b)^\circ$  for  $0 \leq x \leq 360$  is drawn on the grid.



(a) Find the value of  $a$  and the value of  $b$ .

$a = \dots\dots\dots$

$b = \dots\dots\dots$

(2)

Another curve  $C$  has equation  $y = f(x)$

The coordinates of the minimum point of  $C$  are  $(4, 5)$

(b) Write down the coordinates of the minimum point of the curve with equation

(i)  $y = f(2x)$

(....., .....)

(ii)  $y = f(x) - 7$

(....., .....)

(2)

(Total for Question 22 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2020

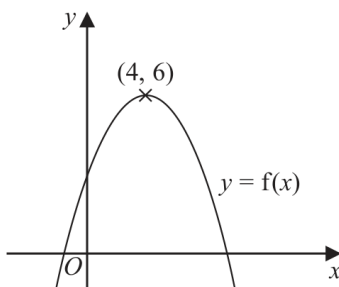
Q#: 21

Marks: 4

TOPIC: Transformations of Graphs

Source: Jan 2020 P2H | PDF pages: 21-21

21 The diagram shows a sketch of part of the curve with equation  $y = f(x)$



There is one maximum point on this curve.  
The coordinates of this maximum point are (4, 6)

(a) Write down the coordinates of the maximum point on the curve with equation

(i)  $y = f(x + 4)$

(....., .....) (1)

(ii)  $y = f(2x)$

(....., .....) (2)

The equation of a curve **C** is  $y = x^2 + 3x + 4$

The curve **C** is transformed to curve **S** under the translation  $\begin{pmatrix} 4 \\ 6 \end{pmatrix}$

(b) Find an equation of curve **S**.

*You do not need to simplify the equation.*

..... (2)

**(Total for Question 21 is 4 marks)**

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May-Nov 2020

Q#: 25

Marks: 3

TOPIC: Transformations of Graphs

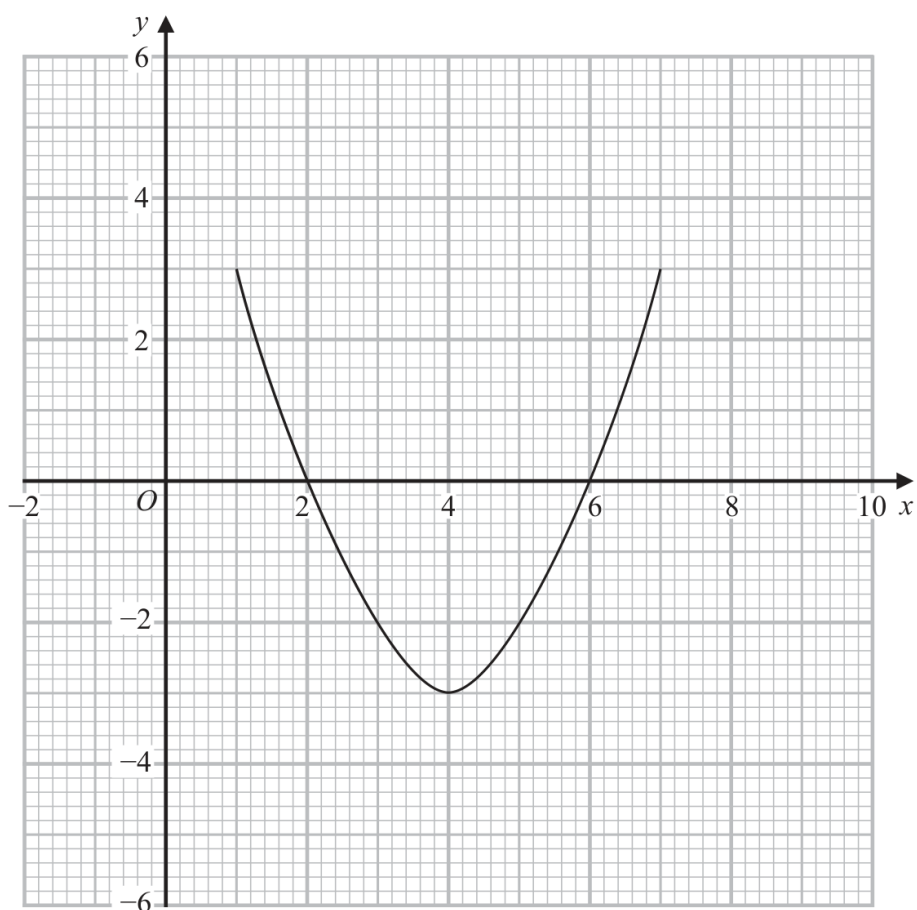
Source: May-Nov 2020 P1H | PDF pages: 27-27

25 The curve with equation  $y = g(x)$  is transformed to the curve with equation  $y = -g(x)$  by the single transformation **T**.

(a) Describe fully the transformation **T**.

(1)

The diagram shows the graph of  $y = f(x)$



(b) On the grid, draw the graph of  $y = 2f(x - 1)$

(2)

**(Total for Question 25 is 3 marks)****WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: May-Nov 2020

Q#: 20

Marks: 2

TOPIC: Transformations of Graphs

Source: May-Nov 2020 P1HR | PDF pages: 20-20

- 20** A curve has equation  $y = f(x)$   
 There is only one maximum point on the curve.  
 The coordinates of this maximum point are  $(-3, 4)$

Write down the coordinates of the maximum point on the curve with equation

(i)  $y = f(x) - 6$

(..... , .....) )

(ii)  $y = f(2x)$

(..... , .....) )

**(Total for Question 20 is 2 marks)**

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jan 2021

Q#: 21

Marks: 4

TOPIC: Transformations of Graphs

Source: Jan 2021 P1H | PDF pages: 24-24

21 A curve has equation  $y = f(x)$

The coordinates of the minimum point on this curve are  $(-9, 15)$

(a) Write down the coordinates of the minimum point on the curve with equation

(i)  $y = f(x + 3)$

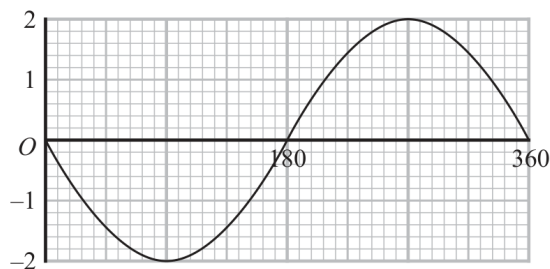
(....., .....) (1)

(ii)  $y = \frac{1}{3}f(x)$

(....., .....) (2)

(2)

The graph of  $y = a \cos(x + b)^\circ$  for  $0 \leq x \leq 360$  is drawn on the grid below.



Given that  $a > 0$  and that  $0 < b < 360$

(b) find the value of  $a$  and the value of  $b$ .

$a =$  .....

$b =$  .....

(2)

(Total for Question 21 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2021

Q#: 21

Marks: 6

TOPIC: Transformations of Graphs

Source: Nov 2021 P2H | PDF pages: 24-25

21 The curve C has equation  $y = f(x)$  where  $f(x) = 9 - 3(x + 2)^2$   
The point A is the maximum point on C.

(a) Write down the coordinates of A.

(....., .....)  
(1)

The curve C is transformed to the curve S by a translation of  $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$

(b) Find an equation for the curve S.

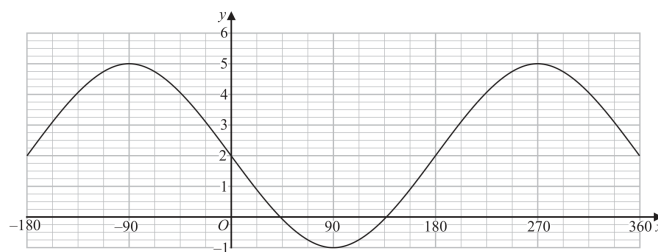
(1)

The curve C is transformed to the curve T.  
The curve T has equation  $y = 3(x + 2)^2 - 9$

(c) Describe fully the transformation that maps curve C onto curve T.

(1)

The graph of  $y = a \cos(x - b)^\circ + c$  for  $-180 \leq x \leq 360$  is drawn on the grid below.



(d) Find the value of  $a$ , the value of  $b$  and the value of  $c$ .

$a =$  .....

$b =$  .....

$c =$  .....

(3)

(Total for Question 21 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jan 2022

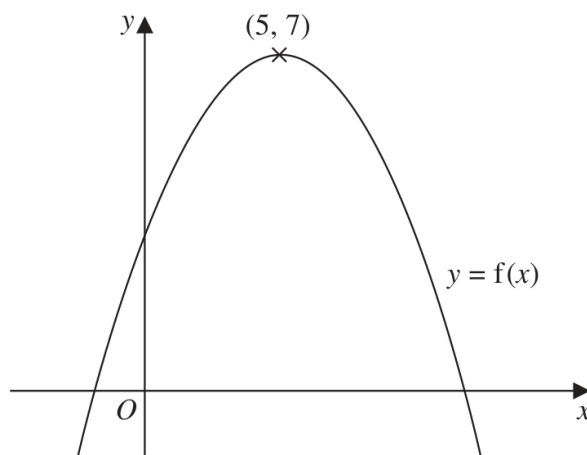
Q#: 23

Marks: 2

TOPIC: Transformations of Graphs

Source: Jan 2022 P1H | PDF pages: 26-26

23 The diagram shows a sketch of the curve with equation  $y = f(x)$



There is only one maximum point on the curve.  
The coordinates of this maximum point are  $(5, 7)$

Write down the coordinates of the maximum point on the curve with equation

(i)  $y = f(x + 9)$

(....., .....)

(ii)  $y = f(x) + 3$

(....., .....)

(Total for Question 23 is 2 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

Worked solution by Dr. Eslam Ahmed – forthcoming.

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jan 2022

Q#: 20

Marks: 6

TOPIC: Transformations of Graphs

Source: Jan 2022 P1HR | PDF pages: 24-25

20 The curve with equation  $y = f(x)$  has one turning point.

The coordinates of this turning point are  $(-6, -4)$

(a) Write down the coordinates of the turning point on the curve with equation

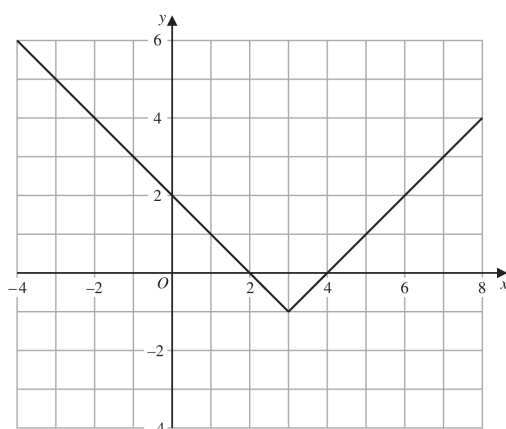
(i)  $y = f(x) + 5$

(....., .....) (1)

(ii)  $y = f(3x)$

(....., .....) (2)

The graph of  $y = g(x)$  is shown on the grid below.



(b) On the grid, sketch the graph of  $y = 2g(x)$  for  $-1 \leq x \leq 7$

(2)

The graph of  $y = h(x)$  intersects the  $x$ -axis at two points.

The coordinates of the two points are  $(-1, 0)$  and  $(6, 0)$

The graph of  $y = h(x + a)$  passes through the point with coordinates  $(2, 0)$ , where  $a$  is a constant.

(c) Find the two possible values of  $a$

(2)

(Total for Question 20 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jun 2022

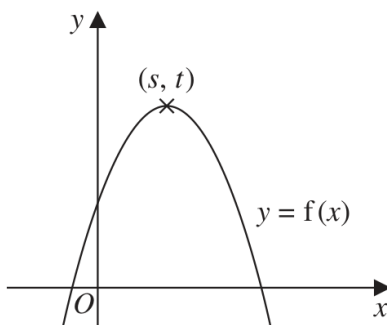
Q#: 20

Marks: 2

TOPIC: Transformations of Graphs

Source: Jun 2022 P1H | PDF pages: 21-21

20 The diagram shows a sketch of part of the curve with equation  $y = f(x)$



There is one maximum point on this curve.

The coordinates of this maximum point are  $(s, t)$

Find, in terms of  $s$  and  $t$ , the coordinates of the maximum point on the curve with equation

(i)  $y = f(x - 2)$

(....., .....)  
(1)

(ii)  $y = 3f(x)$

(....., .....)  
(1)

**(Total for Question 20 is 2 marks)**

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2022

Q#: 22

Marks: 4

TOPIC: Transformations of Graphs

Source: Jun 2022 P2HR | PDF pages: 24-24

22 The point  $A$  with coordinates  $(-3, 2)$  lies on the straight line with equation  $y = f(x)$

(a) Find the coordinates of the image of the point  $A$  on the straight line with equation

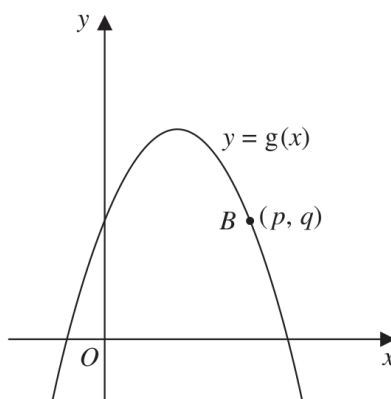
(i)  $y = f(x) - 3$

(....., .....)  
(1)

(ii)  $y = f\left(\frac{x}{2}\right)$

(....., .....)  
(1)

Here is a sketch of part of the curve with equation  $y = g(x)$



The point  $B$  with coordinates  $(p, q)$  lies on the curve.

(b) Find the coordinates of the image of the point  $B$  on the curve with equation

$$y = -g(x - c)$$

where  $c$  is a constant.

(....., .....)  
(2)

(Total for Question 22 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May 2023

Q#: 21

Marks: 2

TOPIC: Transformations of Graphs

Source: May 2023 P1H | PDF pages: 23-23

**21** A curve has equation  $y = f(x)$ 

There is only one turning point on the curve.

The coordinates of this turning point are (6, 5)

Write down the coordinates of the turning point on the curve with equation

(a)  $y = f(x - 4)$

(....., .....)  
(1)

(b)  $y = f(3x)$

(....., .....)  
(1)**(Total for Question 21 is 2 marks)****WORKED SOLUTION***Dr. Eslam Ahmed**Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: May 2023

Q#: 20

Marks: 7

TOPIC: Transformations of Graphs

Source: May 2023 P1HR | PDF pages: 20-20

**20** Curve **C** has equation  $y = f(x)$ The graph of curve **C** has one maximum point.

The coordinates of this maximum point are (3, 5)

(a) Write down the coordinates of the maximum point on the curve with equation

(i)  $y = 2f(x)$

(....., .....)  
(1)

(ii)  $y = f(x) - 7$

(....., .....)  
(1)

(iii)  $y = f(-x)$

(....., .....)  
(1)Curve **L** has equation  $y = x^2 + 7x + 20$ Curve **L** is transformed to curve **S** under the translation  $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$ (b) Find an equation for **S**Give your answer in the form  $y = ax^2 + bx + c$  $y = \dots\dots\dots$   
(4)**(Total for Question 20 is 7 marks)****WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2023

Q#: 24

Marks: 4

TOPIC: Transformations of Graphs

Source: Nov 2023 P1H | PDF pages: 28-28

24 The curve with equation  $f(x) = 5x^2 + 9x + 2$  is transformed to the curve with equation

$$g(x) = 5(x+4)^2 + 9(x+4) + 8 \text{ by the translation } \begin{pmatrix} a \\ b \end{pmatrix}$$

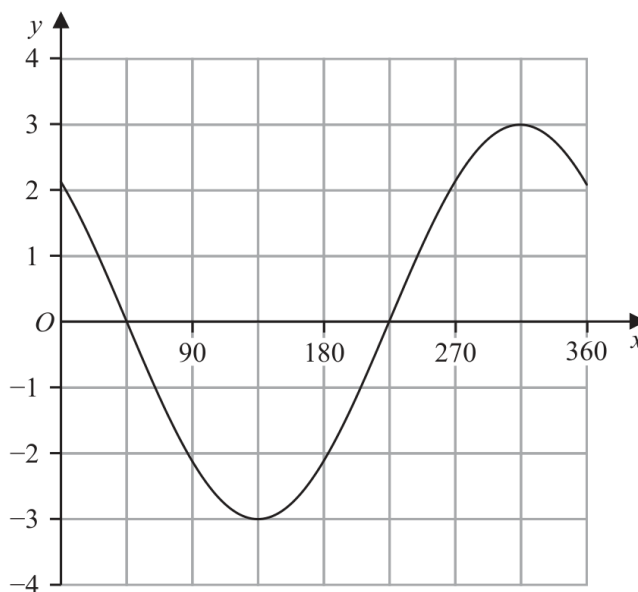
(a) Write down the value of  $a$  and the value of  $b$

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots$$

(2)

The graph of  $y = p \cos(x+q)^\circ$  for  $0 \leq x \leq 360$  is drawn on the grid below.



Given that  $p > 0$  and  $0 < q < 360$

(b) find the value of  $p$  and the value of  $q$

$$p = \dots\dots\dots$$

$$q = \dots\dots\dots$$

(2)

**(Total for Question 24 is 4 marks)****WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May 2024

Q#: 21

Marks: 2

TOPIC: Transformations of Graphs

Source: May 2024 P1H | PDF pages: 22-22

**21** A curve has equation  $y = f(x)$ 

There is one minimum point on this curve.

The coordinates of this minimum point are  $(5, -4)$ 

Write down the coordinates of the minimum point on the curve with equation

(i)  $y = f(x + 7)$

(.....,.....)  
(1)

(ii)  $y = f(x) - 6$

(.....,.....)  
(1)**(Total for Question 21 is 2 marks)****WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2024

Q#: 23

Marks: 2

TOPIC: Transformations of Graphs

Source: Jun 2024 P2HR | PDF pages: 25-25

**23** A curve has equation  $y = f(x)$ The coordinates of the minimum point on this curve are  $(6, -3)$ 

Write down the coordinates of the minimum point on the curve with equation

(i)  $y = f(x) + 10$

(..... , .....)  
(1)

(ii)  $y = f(3x)$

(..... , .....)  
(1)**(Total for Question 23 is 2 marks)****WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jun 2025

Q#: 21

Marks: 3

TOPIC: Transformations of Graphs

Source: Jun 2025 P1HR | PDF pages: 21-21

21 The curve with equation  $y = f(x)$  has one turning point.  
The coordinates of this turning point are  $(-6, 9)$

- (a) Write down the coordinates of the turning point on the curve with equation  $y = f(3x)$

(....., .....)  
(1)

The curve **C** with equation  $y = g(x)$  is transformed to give the curve **S** with equation  $y = g(x + a) + b$

The point  $(4, -5)$  on **C** is mapped to the point  $(1, -16)$  on **S**

- (b) Write down the value of  $a$  and the value of  $b$

$a = \dots\dots\dots$

$b = \dots\dots\dots$

(2)

(Total for Question 21 is 3 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2025

Q#: 24

Marks: 3

TOPIC: Transformations of Graphs

Source: Nov 2025 P1H | PDF pages: 20-20

**24** A curve has equation  $y = f(x)$ 

There is only one turning point on the curve.

The coordinates of this turning point are (4, 3)

Write down the coordinates of the turning point on the curve with equation

(i)  $y = f(x + 5)$

(..... , .....)  
(1)

(ii)  $y = f(x) + 7$

(..... , .....)  
(1)

(iii)  $y = f(2x)$

(..... , .....)  
(1)**(Total for Question 24 is 3 marks)****WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

# Differentiation

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## Sequences, Functions & Graphs

12 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jan 2020

Q#: 23

Marks: 6

TOPIC: Differentiation

Source: Jan 2020 P1HR | PDF pages: 24-24

- 23 A particle moves along a straight line.  
The fixed point  $O$  lies on this line.  
The displacement of the particle from  $O$  at time  $t$  seconds,  $t \geq 0$ , is  $s$  metres where

$$s = t^3 + 4t^2 - 5t + 7$$

At time  $T$  seconds the velocity of  $P$  is  $V$  m/s where  $V \geq -5$

Find an expression for  $T$  in terms of  $V$ .

Give your expression in the form  $\frac{-4 + \sqrt{k + mV}}{3}$  where  $k$  and  $m$  are integers to be found.

$T = \dots\dots\dots$

**(Total for Question 23 is 6 marks)**

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May-Nov 2020

Q#: 23

Marks: 4

TOPIC: Differentiation

Source: May-Nov 2020 P1H | PDF pages: 25-25

23 Curve **C** has equation  $y = px^3 - mx$  where  $p$  and  $m$  are positive integers.

Find the range of values of  $x$ , in terms of  $p$  and  $m$ , for which the gradient of **C** is negative.

.....  
(Total for Question 23 is 4 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jan 2021

Q#: 20

Marks: 5

TOPIC: Differentiation

Source: Jan 2021 P1HR | PDF pages: 23-23

- 20 A particle  $P$  is moving along a straight line.  
The fixed point  $O$  lies on the line.

At time  $t$  seconds ( $t \geq 0$ ), the displacement of  $P$  from  $O$  is  $s$  metres where

$$s = t^3 - 9t^2 + 33t - 6$$

Find the minimum speed of  $P$ .

..... m/s

(Total for Question 20 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: May 2021

Q#: 21

Marks: 5

TOPIC: Differentiation

Source: May 2021 P2H | PDF pages: 24-24

- 21 The point  $A$  is the only stationary point on the curve with equation  $y = kx^2 + \frac{16}{x}$  where  $k$  is a constant.

Given that the coordinates of  $A$  are  $\left(\frac{2}{3}, a\right)$

find the value of  $a$ .

Show your working clearly.

$a = \dots\dots\dots$

(Total for Question 21 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jan 2022

Q#: 24

Marks: 6

TOPIC: Differentiation

Source: Jan 2022 P1H | PDF pages: 27-27

24 The curve C has equation  $y = ax^3 + bx^2 - 12x + 6$  where  $a$  and  $b$  are constants.

The point A with coordinates  $(2, -6)$  lies on C

The gradient of the curve at A is 16

Find the  $y$  coordinate of the point on the curve whose  $x$  coordinate is 3

Show clear algebraic working.

$y = \dots\dots\dots$

**(Total for Question 24 is 6 marks)**

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jan 2022

Q#: 23

Marks: 6

TOPIC: Differentiation

Source: Jan 2022 P1HR | PDF pages: 28-29

23 Two particles,  $P$  and  $Q$ , move along a straight line.  
The fixed point  $O$  lies on this line.

The displacement of  $P$  from  $O$  at time  $t$  seconds is  $s$  metres, where

$$s = t^3 - 4t^2 + 5t \quad \text{for } t > 1$$

The displacement of  $Q$  from  $O$  at time  $t$  seconds is  $x$  metres, where

$$x = t^2 - 4t + 4 \quad \text{for } t > 1$$

Find the range of values of  $t$  where  $t > 1$  for which both particles are moving in the same direction along the straight line.

(Total for Question 23 is 6 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2022

Q#: 24

Marks: 5

TOPIC: Differentiation

Source: Jan 2022 P2H | PDF pages: 26-26

24 A particle  $P$  moves along a straight line that passes through the fixed point  $O$

The displacement,  $x$  metres, of  $P$  from  $O$  at time  $t$  seconds, where  $t \geq 0$ , is given by

$$x = 4t^3 - 27t + 8$$

The direction of motion of  $P$  reverses when  $P$  is at the point  $A$  on the line.

The acceleration of  $P$  at the instant when  $P$  is at  $A$  is  $a \text{ m/s}^2$

Find the value of  $a$

$$a = \dots\dots\dots$$

(Total for Question 24 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jun 2022

Q#: 22

Marks: 7

TOPIC: Differentiation

Source: Jun 2022 P1HR | PDF pages: 24-25

22 The diagram shows a sketch of part of the curve with equation  $y = x^2 - \frac{p}{x}$  where  $p$  is a positive constant.

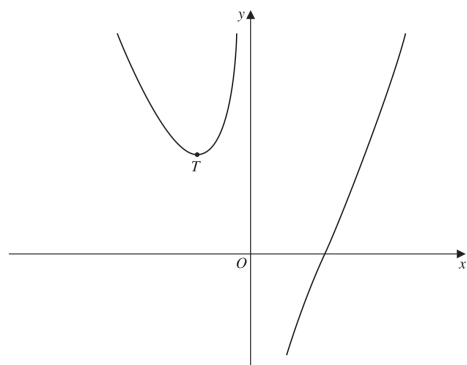


Diagram NOT accurately drawn

For all values of  $p$ , the curve has exactly one turning point and this turning point is a minimum shown as the point  $T$  in the sketch.

For the curve where the  $x$  coordinate of  $T$  is  $-3$

(a) find the value of  $p$

$p = \dots\dots\dots$   
(4)

The line with equation  $y = k$  is a tangent to the curve with equation  $y = x^2 - \frac{16}{x}$

(b) Find the value of  $k$

$k = \dots\dots\dots$   
(3)

(Total for Question 22 is 7 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: May 2023

Q#: 21

Marks: 6

TOPIC: Differentiation

Source: May 2023 P1HR | PDF pages: 21-21

21 The curve **T** has equation  $y = x^3 - 2x^2 - 9x + 15$

(a) Find  $\frac{dy}{dx}$

$$\frac{dy}{dx} = \dots\dots\dots$$

(2)

(b) Find the range of values of  $x$  for which **T** has a positive gradient.  
Give your values correct to 3 significant figures.  
Show your working clearly.

\dots\dots\dots

(4)

**(Total for Question 21 is 6 marks)**

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2024

Q#: 20

Marks: 4

TOPIC: Differentiation

Source: Nov 2024 P1H | PDF pages: 21-21

**20** The curve with equation  $y = 2x^4 - 64x$  has a minimum point.

Find an equation of the tangent to the curve at the minimum point.  
Show clear algebraic working.

.....  
(Total for Question 20 is 4 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2025

Q#: 22

Marks: 5

TOPIC: Differentiation

Source: Jun 2025 P2HR | PDF pages: 22-22

22 The diagram shows a solid cuboid.

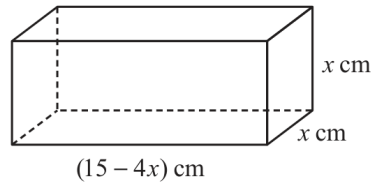


Diagram **NOT** accurately drawn

The volume of the cuboid is  $V$  cm<sup>3</sup>

Find the maximum value of  $V$

(Total for Question 22 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2025

Q#: 22

Marks: 6

TOPIC: Differentiation

Source: Nov 2025 P2H | PDF pages: 22-22

**22** Curve **C** has equation  $y = x^3 - 16x + 7$

At two points on **C**, the gradient is 11

The tangents to **C** at these two points have equations of the form  $y = ax + b$

Work out the two possible values of  $b$

Show clear algebraic working.

.....  
(Total for Question 22 is 6 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

## Unit IV

# Geometry & Trigonometry

---

Dr. Eslam Ahmed

## Topic 39

# Standard & Compound Units

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### Geometry & Trigonometry

2 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jan 2022

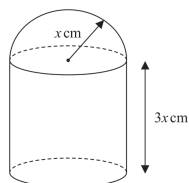
Q#: 21

Marks: 6

TOPIC: **Standard & Compound Units**

Source: Jan 2022 P2HR | PDF pages: 26-27

- 21 The diagram shows a solid made from a cylinder and a hemisphere.  
The cylinder and the hemisphere are both made from the same metal.

Diagram NOT  
accurately drawn

The plane face of the hemisphere coincides with the upper plane face of the cylinder.

The radius of the cylinder and the radius of the hemisphere are both  $x$  cm.

The height of the cylinder is  $3x$  cm.

The total surface area of the solid is  $81\pi$  cm<sup>2</sup>

The mass of the solid is 840 grams.

The following table gives the density of each of four metals.

Metal	Density (g/cm <sup>3</sup> )
Aluminium	2.7
Nickel	8.9
Gold	19.3
Silver	10.5

The metal used to make the solid is one of the metals in the table.

Determine the metal used to make the solid.

Show your working clearly.

(Total for Question 21 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2025

Q#: 26

Marks: 6

TOPIC: **Standard & Compound Units**

Source: Nov 2025 P2H | PDF pages: 26-27

26 A solid cone is joined to a solid hemisphere to make the solid shown below.

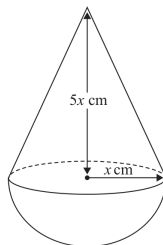


Diagram NOT accurately drawn

The cone is made from copper.  
The density of copper is  $9 \text{ g/cm}^3$

The hemisphere is made from a different metal.

The total mass of the solid is  $4752\pi$  grams

The total volume of the solid is  $504\pi \text{ cm}^3$

Work out the density of the hemisphere.  
Show your working clearly.

.....  $\text{g/cm}^3$

(Total for Question 26 is 6 marks)

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

## Topic 40

# Angles in Polygons & Parallel Lines

---

### Geometry & Trigonometry

1 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jun 2022

Q#: 23

Marks: 6

TOPIC: **Angles in Polygons & Parallel Lines**

Source: Jun 2022 P1H | PDF pages: 24-25

23 A polygon has  $n$  sides, where  $n > 5$ 

When arranged in order of size, starting with the largest number, the sizes of the interior angles of the polygon, in degrees, are the terms of an arithmetic sequence.

Here are the first five terms of this sequence.

177    175    173    171    169

Find the value of  $n$   
Show clear algebraic working.

Question 23 continued

$n = \dots\dots\dots$

(Total for Question 23 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

## Topic 41

# Bearings, Scale Drawing & Constructions

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### Geometry & Trigonometry

1 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2024

Q#: 24

Marks: 6

TOPIC: Bearings, Scale Drawing &amp; Constructions

Source: Nov 2024 P2H | PDF pages: 24-25

24  $A$ ,  $B$  and  $C$  are three points on horizontal ground.

$AB = 8.4$  metres  $BC = 9.2$  metres

$B$  is on a bearing of  $067^\circ$  from  $A$

$C$  is on a bearing of  $129^\circ$  from  $B$

Calculate the bearing of  $A$  from  $C$

Give your answer correct to the nearest degree.

(Total for Question 24 is 6 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

## Topic 42

# Circle Theorems

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### Geometry & Trigonometry

2 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

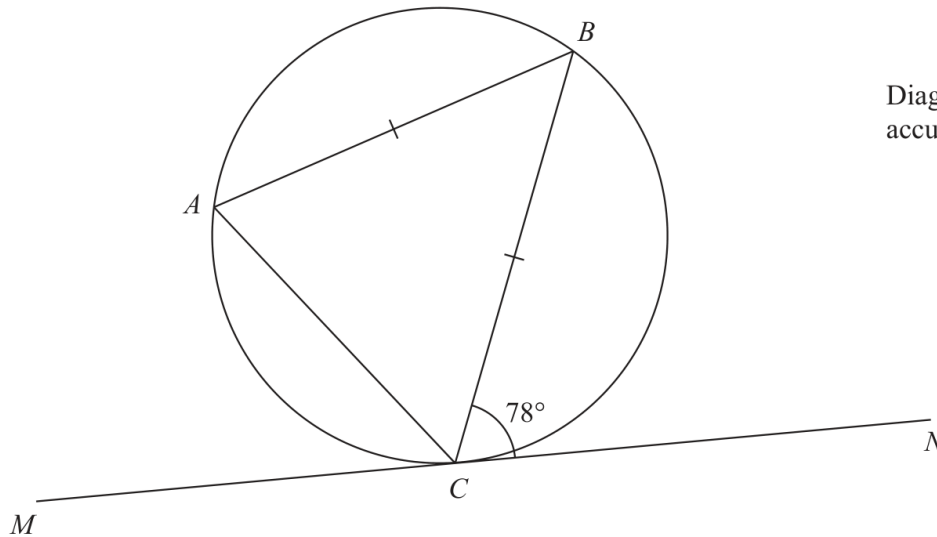
Session: Jun 2023

Q#: 20

Marks: 2

TOPIC: Circle Theorems

Source: Jun 2023 P2HR | PDF pages: 20-20

20  $A$ ,  $B$  and  $C$  are points on a circle.Diagram **NOT**  
accurately drawn $MN$  is the tangent to the circle at  $C$  $AB = CB$ Angle  $BCN = 78^\circ$ Find the size of angle  $ABC$ .....  
(Total for Question 20 is 2 marks)**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jun 2025

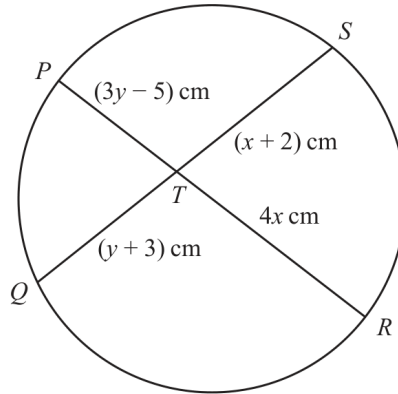
Q#: 23

Marks: 5

TOPIC: Circle Theorems

Source: Jun 2025 P1HR | PDF pages: 23-23

23

Diagram **NOT**  
accurately drawn $PTR$  and  $QTS$  are chords of a circle.

$$PT = (3y - 5) \text{ cm} \quad QT = (y + 3) \text{ cm} \quad RT = 4x \text{ cm} \quad ST = (x + 2) \text{ cm}$$

Find an expression for  $y$  in terms of  $x$ 

$$y = \dots\dots\dots$$

**Total for Question 23 is 5 marks)****WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

## Topic 43

# Area & Perimeter

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### Geometry & Trigonometry

2 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: May-Nov 2020

Q#: 22

Marks: 6

TOPIC: Area & Perimeter

Source: May-Nov 2020 P1HR | PDF pages: 22-23

22 The diagram shows a regular octagon  $ABCDEFGH$ .

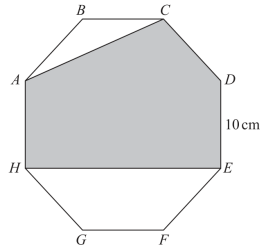


Diagram NOT accurately drawn

Each side of the octagon has length 10 cm.

Find the area of the shaded region  $ACDEH$ .  
Give your answer correct to the nearest  $\text{cm}^2$

.....  $\text{cm}^2$

(Total for Question 22 is 6 marks)

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2021

Q#: 20

Marks: 4

TOPIC: Area & Perimeter

Source: Jan 2021 P2H | PDF pages: 23-23

20

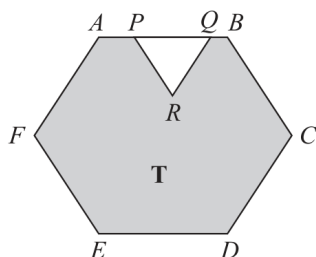


Diagram NOT accurately drawn

The diagram shows a shaded region **T** formed by removing an equilateral triangle  $PQR$  from a regular hexagon  $ABCDEF$ .

The points  $P$  and  $Q$  lie on  $AB$  such that  $AB = 1.5 \times PQ$

Given that the area of region **T** is  $72\sqrt{3}$  cm<sup>2</sup>

work out the length of  $PQ$ .

..... cm

(Total for Question 20 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

## Topic 44

# Circles, Arcs & Sectors

---

### Geometry & Trigonometry

10 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2021

Q#: 22

Marks: 6

TOPIC: Circles, Arcs &amp; Sectors

Source: Jan 2021 P2H | PDF pages: 26-27

22 The diagram shows a sector  $OBC$  of a circle with centre  $O$  and radius  $(6 + x)$  cm.

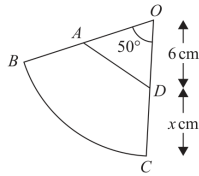


Diagram NOT  
accurately drawn

$A$  is the point on  $OB$  and  $D$  is the point on  $OC$  such that  $OA = OD = 6$  cm

Angle  $BOC = 50^\circ$

Given that

the perimeter of sector  $OBC = 2 \times$  the perimeter of triangle  $OAD$

find the value of  $x$ .

Give your answer correct to 3 significant figures.

$x = \dots\dots\dots$

(Total for Question 22 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jan 2021

Q#: 20

Marks: 5

TOPIC: Circles, Arcs &amp; Sectors

Source: Jan 2021 P2HR | PDF pages: 19-19

20  $A, B$  and  $C$  are points on a circle with centre  $O$ .

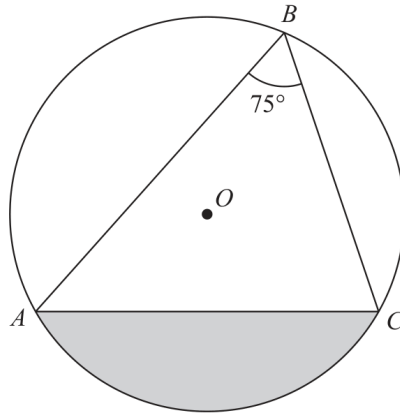


Diagram **NOT**  
accurately drawn

Angle  $ABC = 75^\circ$

The area of the shaded segment is  $200 \text{ cm}^2$

Calculate the radius of the circle.

Give your answer correct to 3 significant figures.

..... cm

(Total for Question 20 is 5 marks)

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May 2021

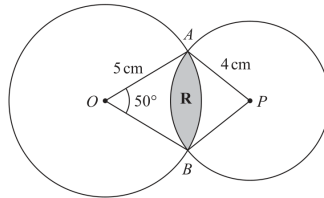
Q#: 25

Marks: 6

TOPIC: Circles, Arcs &amp; Sectors

Source: May 2021 P1H | PDF pages: 24-25

- 25 The diagram shows two circles such that the region **R**, shown shaded in the diagram, is the region common to both circles.

Diagram NOT  
accurately drawn

One of the circles has centre  $O$  and radius 5 cm.  
The other circle has centre  $P$  and radius 4 cm.  
Angle  $AOB = 50^\circ$

Calculate the area of region **R**.  
Give your answer correct to 3 significant figures.

..... cm<sup>2</sup>

(Total for Question 25 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2022

Q#: 20

Marks: 4

TOPIC: Circles, Arcs &amp; Sectors

Source: Jun 2022 P2H | PDF pages: 20-20

20 The diagram shows four identical circles drawn inside a square.

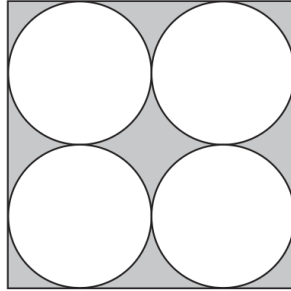


Diagram **NOT**  
accurately drawn

Each circle touches two other circles and two sides of the square.

The region inside the square that is outside the circles, shown shaded in the diagram, has a total area of  $40\text{ cm}^2$

Work out the perimeter of the square.

Give your answer correct to 3 significant figures.

..... cm

**(Total for Question 20 is 4 marks)**

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May 2023

Q#: 22

Marks: 6

TOPIC: Circles, Arcs & Sectors

Source: May 2023 P1H | PDF pages: 24-25

22 The diagram shows two circles with centre  $O$  and a regular pentagon  $ABCDE$

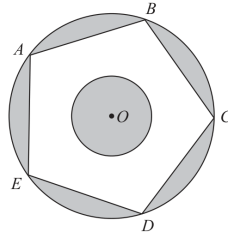


Diagram NOT accurately drawn

$A, B, C, D$  and  $E$  are points on the larger circle.  
The pentagon has sides of length 8 cm.

The diagram is shaded such that

$$\text{shaded area} = \text{unshaded area}$$

Work out the radius of the smaller circle.  
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 22 is 6 marks)

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2023

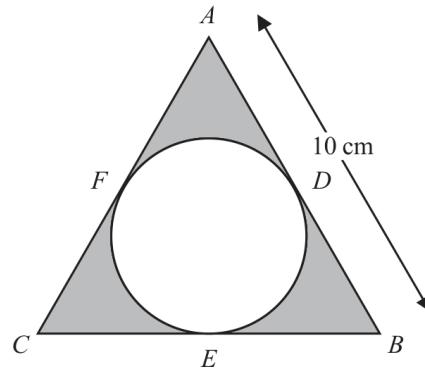
Q#: 20

Marks: 4

TOPIC: Circles, Arcs &amp; Sectors

Source: Nov 2023 P2H | PDF pages: 18-18

- 20 The diagram shows equilateral triangle  $ABC$  with sides of length 10 cm. A circle is drawn inside the triangle.

Diagram **NOT** accurately drawn

$D$ ,  $E$  and  $F$  are points on the circle.

$ADB$ ,  $BEC$  and  $CFA$  are tangents to the circle.

Calculate the total area of the regions shown shaded in the diagram.  
Give your answer correct to 3 significant figures.

.....  $\text{cm}^2$ **(Total for Question 20 is 4 marks)****WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May 2024

Q#: 20

Marks: 4

TOPIC: Circles, Arcs &amp; Sectors

Source: May 2024 P1H | PDF pages: 21-21

20 The diagram shows a sector  $OAC$  of a circle centre  $O$

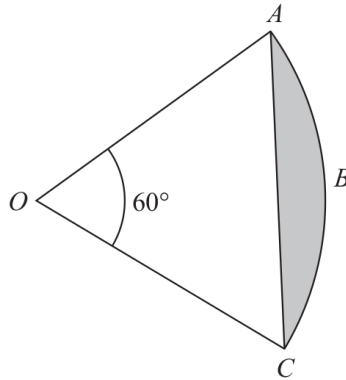


Diagram **NOT**  
accurately drawn

Angle  $AOC = 60^\circ$

The area of the shaded segment  $ABC$  is  $38 \text{ cm}^2$

Work out the perimeter of the shaded segment  $ABC$   
Give your answer correct to one decimal place.

..... cm

(Total for Question 20 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

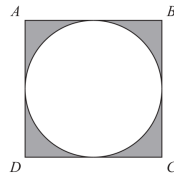
Session: Jun 2024

Q#: 21

Marks: 5

TOPIC: Circles, Arcs &amp; Sectors

Source: Jun 2024 P2H | PDF pages: 20-21

21 The diagram shows a square  $ABCD$  and a circle.Diagram NOT  
accurately drawn

The sides of the square are tangents to the circle.

The total area of the shaded regions is  $80 \text{ cm}^2$ Work out the length of  $AC$ 

Give your answer correct to 3 significant figures.

..... cm

(Total for Question 21 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2024

Q#: 25

Marks: 5

TOPIC: Circles, Arcs &amp; Sectors

Source: Nov 2024 P2H | PDF pages: 26-27

25 The diagram shows an equilateral triangle  $ABC$  and a circle with centre  $O$

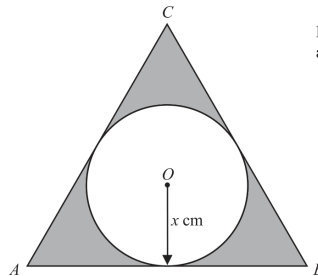


Diagram NOT  
accurately drawn

$AB$ ,  $BC$  and  $CA$  are tangents to the circle.

The radius of the circle is  $x$  cm

The total area, in  $\text{cm}^2$ , of the regions shown shaded in the diagram is  $nx^2$

Find the value of  $n$

Give your answer correct to 3 significant figures.

$n = \dots\dots\dots$

(Total for Question 25 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jun 2025

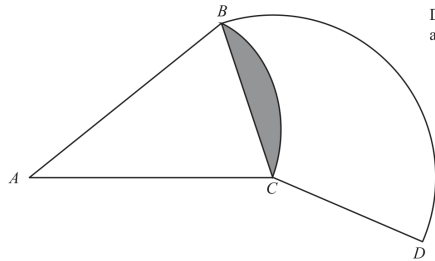
Q#: 25

Marks: 6

TOPIC: Circles, Arcs &amp; Sectors

Source: Jun 2025 P1HR | PDF pages: 26-27

25

Diagram NOT  
accurately drawn $BAC$  is a sector of a circle, centre  $A$  $BCD$  is a sector of a circle, centre  $C$ Angle  $BAC = 40^\circ$ Angle  $BCD = 130^\circ$ Area of shaded segment =  $28 \text{ cm}^2$ Find the length of the arc  $BD$ 

Give your answer correct to 3 significant figures.

..... cm

(Total for Question 25 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

## Topic 45

# Volume & Surface Area

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### Geometry & Trigonometry

9 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2020

Q#: 26

Marks: 6

TOPIC: Volume & Surface Area

Source: Jan 2020 P2H | PDF pages: 26-27

26 Here is a sector,  $AOB$ , of a circle with centre  $O$  and angle  $AOB = x^\circ$

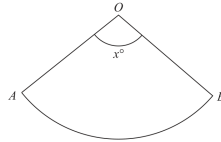


Diagram NOT accurately drawn

The sector can form the curved surface of a cone by joining  $OA$  to  $OB$ .

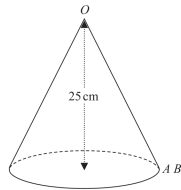


Diagram NOT accurately drawn

The height of the cone is 25 cm.  
The volume of the cone is  $1600\text{ cm}^3$

Work out the value of  $x$ .  
Give your answer correct to the nearest whole number.

$x =$  \_\_\_\_\_

(Total for Question 26 is 6 marks)

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2021

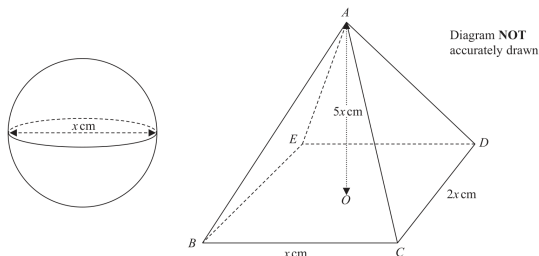
Q#: 22

Marks: 6

TOPIC: Volume & Surface Area

Source: Nov 2021 P2H | PDF pages: 26-27

22 The diagram shows a sphere of diameter  $x$  cm and a pyramid  $ABCDE$  with a horizontal rectangular base  $BCDE$ .



The vertex  $A$  of the pyramid is vertically above the centre  $O$  of the base so that  $AB = AC = AD = AE$ .

$BC = x$  cm,  $CD = 2x$  cm and  $AO = 5x$  cm.

The volume of the sphere is  $288\pi$  cm<sup>3</sup>

Calculate the total surface area of the pyramid.  
Give your answer correct to the nearest cm<sup>2</sup>

..... cm<sup>2</sup>

(Total for Question 22 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jun 2022

Q#: 22

Marks: 5

TOPIC: Volume &amp; Surface Area

Source: Jun 2022 P1H | PDF pages: 23-23

22 A solid is made from a cone and a hemisphere.

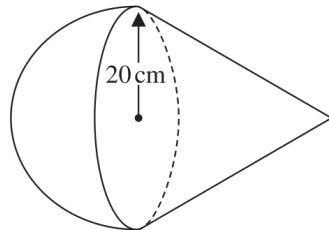


Diagram **NOT**  
accurately drawn

The circular plane face of the hemisphere coincides with the circular base of the cone.  
The radius of the hemisphere and the radius of the circular base of the cone are both 20 cm.

The curved surface area of the cone is  $580\pi\text{cm}^2$

The volume of the solid is  $k\pi\text{cm}^3$

Work out the exact value of  $k$

$k = \dots\dots\dots$

(Total for Question 22 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2023

Q#: 24

Marks: 5

TOPIC: **Volume & Surface Area**

Source: Jun 2023 P2HR | PDF pages: 25-25

- 24 The surface area of sphere **A** is nine times the surface area of sphere **B**  
The difference between the volume of sphere **A** and the volume of sphere **B** is  $117\pi \text{ cm}^3$
- Find the radius of the smaller sphere.  
Show your working clearly.

..... cm

**(Total for Question 24 is 5 marks)****WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2023

Q#: 21

Marks: 5

TOPIC: Volume & Surface Area

Source: Nov 2023 P1H | PDF pages: 24-24

21 Here is a triangular prism  $ABCDEF$

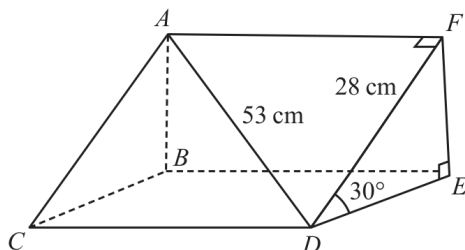


Diagram NOT accurately drawn

- $AD = 53$  cm
- $DF = 28$  cm
- Angle  $FDE = 30^\circ$

Work out the volume of the triangular prism.  
Give your answer correct to the nearest whole number.

.....  $\text{cm}^3$

(Total for Question 21 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May 2024

Q#: 23

Marks: 5

TOPIC: Volume & Surface Area

Source: May 2024 P1H | PDF pages: 24-25

23 A solid shape is made by removing a hemisphere, shown shaded, from a cone as shown in the diagram.

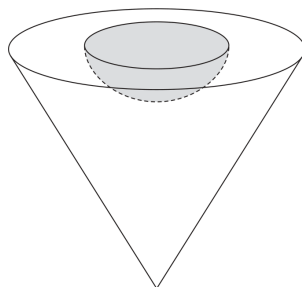


Diagram NOT accurately drawn

The radius of the hemisphere is  $2x$  cm  
 The radius of the base of the cone is  $5x$  cm  
 The vertical height of the cone is  $6x$  cm

The volume of the solid shape is  $6948\pi$  cm<sup>3</sup>

Work out the **total** surface area of the solid hemisphere that has been removed from the cone.

Give your answer correct to the nearest integer.

..... cm<sup>2</sup>

(Total for Question 23 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2024

Q#: 22

Marks: 3

TOPIC: **Volume & Surface Area**

Source: Nov 2024 P1H | PDF pages: 23-23

- 22 The diagram shows a bowl in the shape of a hemisphere.  
The bowl is made from metal.

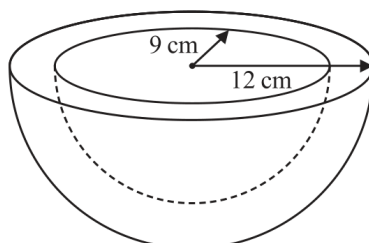


Diagram **NOT**  
accurately drawn

The outer radius of the bowl is 12 cm  
The inner radius of the bowl is 9 cm

The thickness of the bowl is uniform.

Work out the volume of the metal.  
Give your answer correct to the nearest whole number.

..... cm<sup>3</sup>

(Total for Question 22 is 3 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2025

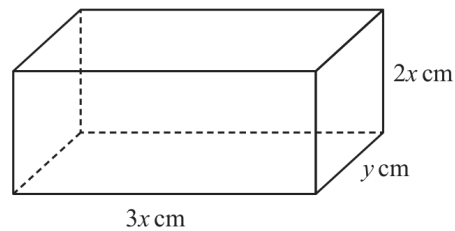
Q#: 21

Marks: 3

TOPIC: Volume &amp; Surface Area

Source: Jun 2025 P2H | PDF pages: 19-19

21 The diagram shows a cuboid.

Diagram NOT  
accurately drawnThe cuboid measures  $3x$  cm by  $2x$  cm by  $y$  cmThe volume of the cuboid is  $1014 \text{ cm}^3$ The total surface area of the cuboid is  $A \text{ cm}^2$ Show that  $A = 12x^2 + \frac{1690}{x}$ 

You must show all the stages of your working.

(Total for Question 21 is 3 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2025

Q#: 26

Marks: 5

TOPIC: Volume & Surface Area

Source: Jun 2025 P2HR | PDF pages: 26-27

26 The diagram shows a solid hemisphere,  $H$

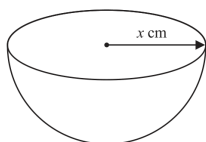


Diagram NOT accurately drawn

The radius of  $H$  is  $x$  cm  
The volume of  $H$  is  $6174\pi$  cm<sup>3</sup>

A bowl is made by removing a solid hemisphere from  $H$  such that the uniform thickness of the bowl is 2 cm

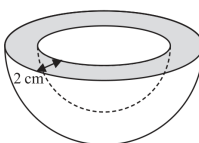


Diagram NOT accurately drawn

Work out the **total** surface area of the bowl.  
Give your answer in terms of  $\pi$

..... cm<sup>2</sup>

(Total for Question 26 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

## Topic 46

# Congruence, Similarity & Geometrical Proof

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### Geometry & Trigonometry

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 47

# Area & Volume of Similar Shapes

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### Geometry & Trigonometry

14 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jan 2020

Q#: 20

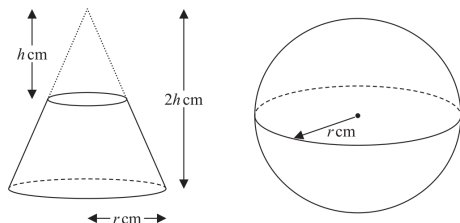
Marks: 5

TOPIC: Area &amp; Volume of Similar Shapes

Source: Jan 2020 P1HR | PDF pages: 20-21

20 The diagram shows a frustum of a cone and a sphere.

The frustum is made by removing a small cone from a large cone.  
The cones are similar.



The height of the small cone is  $h$  cm.  
The height of the large cone is  $2h$  cm.  
The radius of the base of the large cone is  $r$  cm.

The radius of the sphere is  $r$  cm.

Given that the volume of the frustum is equal to the volume of the sphere,

find an expression for  $r$  in terms of  $h$ .  
Give your expression in its simplest form.

$r = \dots\dots\dots$

(Total for Question 20 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jan 2020

Q#: 20

Marks: 4

TOPIC: Area & Volume of Similar Shapes

Source: Jan 2020 P2HR | PDF pages: 21-21

20 The diagram shows two similar vases, A and B.

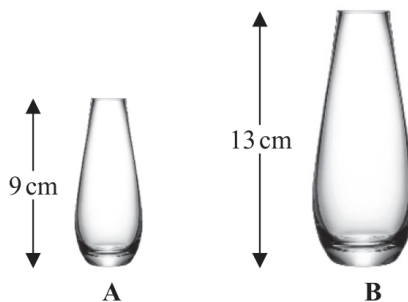


Diagram NOT accurately drawn

The height of vase A is 9 cm and the height of vase B is 13 cm.

Given that

$$\text{surface area of vase A} + \text{surface area of vase B} = 1800 \text{ cm}^2$$

calculate the surface area of vase A.

..... cm<sup>2</sup>

(Total for Question 20 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May-Nov 2020

Q#: 20

Marks: 3

TOPIC: **Area & Volume of Similar Shapes**

Source: May-Nov 2020 P1H | PDF pages: 22-22

**20** **R** and **S** are two similar solid shapes.

Shape **R** has surface area  $108 \text{ cm}^2$  and volume  $135 \text{ cm}^3$

Shape **S** has surface area  $300 \text{ cm}^2$

Work out the volume of shape **S**.

.....  $\text{cm}^3$

**(Total for Question 20 is 3 marks)**

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jan 2021

Q#: 20

Marks: 3

TOPIC: Area & Volume of Similar Shapes

Source: Jan 2021 P1H | PDF pages: 23-23

20 **A** and **B** are two similar solids.

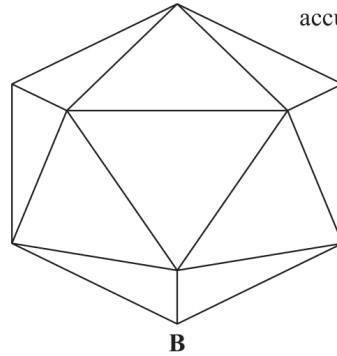
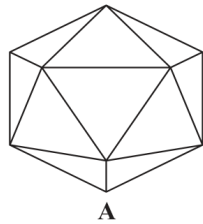


Diagram **NOT** accurately drawn

**A** has a volume of  $1836\text{cm}^3$

**B** has a volume of  $4352\text{cm}^3$

**B** has a total surface area of  $1120\text{cm}^2$

Work out the total surface area of **A**.

..... $\text{cm}^2$

(Total for Question 20 is 3 marks)

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: May 2021

Q#: 20

Marks: 3

TOPIC: **Area & Volume of Similar Shapes**

Source: May 2021 P2H | PDF pages: 23-23

**20** Mathematically similar wooden blocks are made in a workshop.

There are small blocks and there are large blocks.

The volume of each small block is  $300 \text{ cm}^3$

Given that

the surface area of each small block : the surface area of each large block =  $25 : 36$

work out the volume of each large block.

.....  $\text{cm}^3$

**(Total for Question 20 is 3 marks)**

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jun 2022

Q#: 20

Marks: 4

TOPIC: Area &amp; Volume of Similar Shapes

Source: Jun 2022 P1HR | PDF pages: 22-22

20 The diagram shows two similar metal statues.

**A****B**

Diagram **NOT**  
accurately drawn

The volume of statue **B** is 20% less than the volume of statue **A**

The surface area of statue **B** is  $k\%$  less than the surface area of statue **A**

Work out the value of  $k$

Give your answer correct to 3 significant figures.

$k = \dots\dots\dots$

(Total for Question 20 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2022

Q#: 24

Marks: 6

TOPIC: Area & Volume of Similar Shapes

Source: Jun 2022 P2HR | PDF pages: 26-27

**24** The diagram shows a frustum of a cone, and a sphere.

The frustum, shown shaded in the diagram, is made by removing the small cone from the large cone.  
The small cone and the large cone are similar.

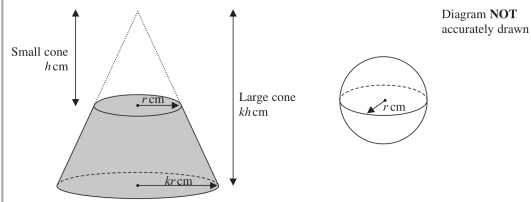


Diagram NOT accurately drawn

The height of the small cone is  $h$  cm and the radius of the base of the small cone is  $r$  cm.  
The height of the large cone is  $kh$  cm and the radius of the base of the large cone is  $kr$  cm.  
The radius of the sphere is  $r$  cm.

The sphere is divided into two hemispheres, each of radius  $r$  cm.

Solid **A** is formed by joining one of the hemispheres to the frustum.  
The plane face of the hemisphere coincides with the upper plane face of the frustum, as shown in the diagram below.

Solid **B** is formed by joining the other hemisphere to the small cone that was removed from the large cone.  
The plane face of the hemisphere coincides with the plane face of the base of the small cone, as shown in the diagram below.

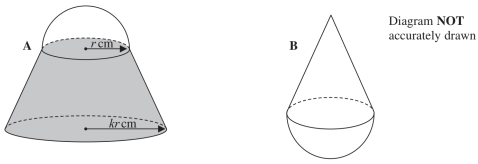


Diagram NOT accurately drawn

The volume of solid **A** is 6 times the volume of solid **B**.

Given that  $k > \sqrt[3]{7}$   
find an expression for  $h$  in terms of  $k$  and  $r$

$h =$  \_\_\_\_\_

(Total for Question 24 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

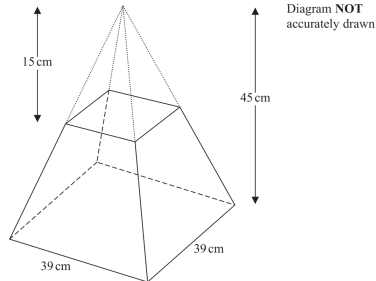
*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM****Paper: P1H****Session: May 2023****Q#: 23****Marks: 5**TOPIC: **Area & Volume of Similar Shapes**

Source: May 2023 P1H | PDF pages: 26-27

23 A frustum is made by removing a small square-based pyramid from a similar large square-based pyramid as shown in the diagram.



The height of the small pyramid is 15 cm.  
 The height of the large pyramid is 45 cm.  
 The square base of the large pyramid has side length 39 cm.

Work out the **total** surface area of the frustum.  
 Give your answer correct to the nearest whole number.

\_\_\_\_\_ cm<sup>2</sup>

(Total for Question 23 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2023

Q#: 23

Marks: 5

TOPIC: **Area & Volume of Similar Shapes**

Source: Nov 2023 P1H | PDF pages: 26-27

23 Solid A is similar to solid B

Here is some information about solid A and solid B

	solid A	solid B
Height (cm)	3	
Area (cm <sup>2</sup> )	7776	486
Volume (cm <sup>3</sup> )	8	2 <sup>14</sup>

Work out the height of solid B  
Give your answer as a decimal.

\_\_\_\_\_ cm

(Total for Question 23 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2023

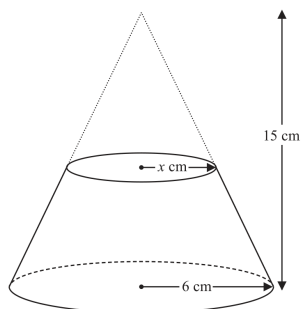
Q#: 23

Marks: 5

TOPIC: Area &amp; Volume of Similar Shapes

Source: Nov 2023 P2H | PDF pages: 22-23

- 23 Here is a frustum of a cone.  
The frustum is made by removing a small cone from a similar large cone.

Diagram NOT  
accurately drawn

The height of the large cone is 15 cm.

The radius of the base of the large cone is 6 cm.

The radius of the base of the small cone is  $x$  cm.Given that the volume of the frustum is  $\frac{4212}{25}\pi \text{ cm}^3$ work out the value of  $x$ 

Show clear algebraic working.

 $x = \dots\dots\dots$ 

(Total for Question 23 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

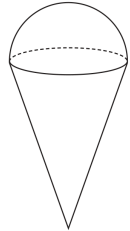
Session: Jun 2024

Q#: 24

Marks: 5

TOPIC: Area &amp; Volume of Similar Shapes

Source: Jun 2024 P2HR | PDF pages: 26-27

24 The diagram shows a solid, **S**, made from a cone and a hemisphere.Diagram NOT  
accurately drawn

The centre of the circular face of the cone coincides with the centre of the flat surface of the hemisphere.

The radius of the circular face of the cone,  $x$  cm, is equal to the radius of the hemisphere.

The total height of **S** is  $4 \times$  the radius of the hemisphere.

A separate sphere has radius  $kx$  cm.

The volume of this sphere is  $12.5 \times$  the volume of **S**

(a) Work out the value of  $k$

$$k = \underline{\hspace{2cm}} \quad (4)$$

A solid, **T**, is similar to solid **S**

The volume of **T** is  $512 \times$  the volume of **S**

The total surface area of **T** is  $d \times$  the total surface area of **S**

(b) Find the value of  $d$

$$d = \underline{\hspace{2cm}} \quad (1)$$

(Total for Question 24 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1HR

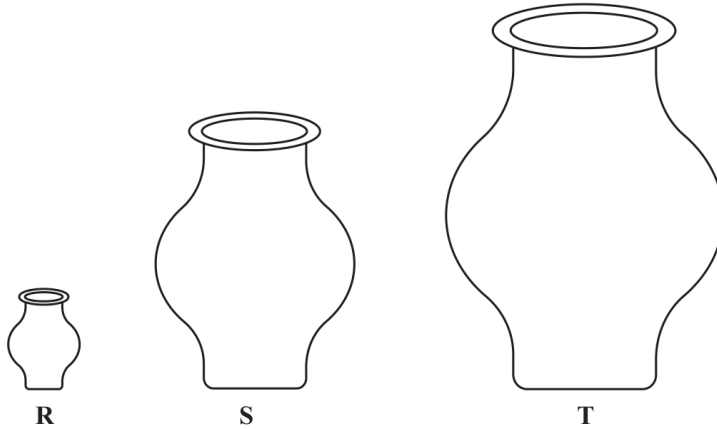
Session: Jun 2025

Q#: 26

Marks: 4

TOPIC: Area &amp; Volume of Similar Shapes

Source: Jun 2025 P1HR | PDF pages: 28-28

26 **R**, **S** and **T** are three similar vases.Diagram **NOT**  
accurately drawnThe volume of vase **S** is 72.8% more than the volume of vase **R**The height of vase **R** is  $h$  cmThe height of vase **T** is  $6h$  cmThe surface area of vase **S** is  $A$  cm<sup>2</sup>The surface area of vase **T** is  $kA$  cm<sup>2</sup>Work out the value of  $k$  $k = \dots\dots\dots$ **(Total for Question 26 is 4 marks)****WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2025

Q#: 26

Marks: 4

TOPIC: **Area & Volume of Similar Shapes**

Source: Jun 2025 P2H | PDF pages: 26-26

**26** **A** and **B** are two similar solids.

The height of solid **A** is 31 cm

The height of solid **B** is 18.6 cm

Given that

$$\text{volume of solid A} - \text{volume of solid B} = 735 \text{ cm}^3$$

find the volume of solid **A**

..... cm<sup>3</sup>

**(Total for Question 26 is 4 marks)**

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2025

Q#: 23

Marks: 3

TOPIC: **Area & Volume of Similar Shapes**

Source: Nov 2025 P2H | PDF pages: 23-23

**23** Shape **P** is similar to shape **Q**The table shows some information about shape **P** and shape **Q**

	Surface area (cm <sup>2</sup> )	Volume (cm <sup>3</sup> )
Shape <b>P</b>	200	672
Shape <b>Q</b>	450	

Work out the volume of shape **Q**..... cm<sup>3</sup>**(Total for Question 23 is 3 marks)****WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

## Topic 48

# Right-Angled Triangles - Pythagoras & Trigonometry

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### Geometry & Trigonometry

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 49

# Sine, Cosine Rule & Area of Triangles

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### Geometry & Trigonometry

5 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jan 2020

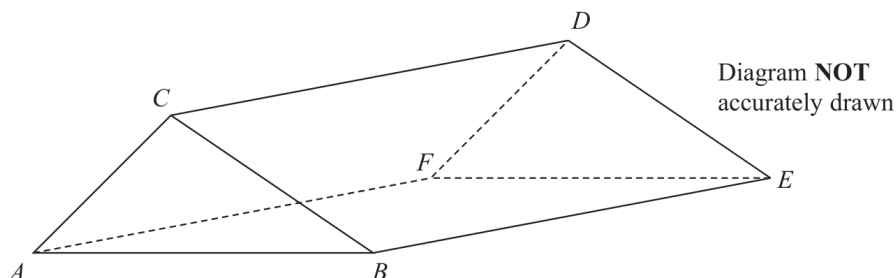
Q#: 21

Marks: 6

TOPIC: Sine, Cosine Rule & Area of Triangles

Source: Jan 2020 P1HR | PDF pages: 22-22

21 The diagram shows the prism  $ABCDEF$  with cross section triangle  $ABC$ .



Angle  $BEC = 40^\circ$  and angle  $ACB$  is obtuse.  
 $AC = 6$  cm and  $CE = 13$  cm

The area of triangle  $ABC$  is  $22$  cm<sup>2</sup>

Calculate the length of  $AB$ .  
 Give your answer correct to one decimal place.

..... cm

**(Total for Question 21 is 6 marks)**

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

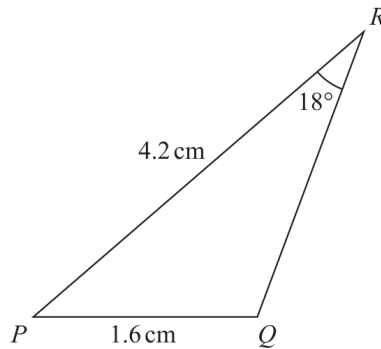
Session: Jan 2022

Q#: 23

Marks: 6

TOPIC: Sine, Cosine Rule &amp; Area of Triangles

Source: Jan 2022 P2H | PDF pages: 25-25

23 The diagram shows triangle  $PQR$ Diagram NOT  
accurately drawn

$$PQ = 1.6 \text{ cm} \quad PR = 4.2 \text{ cm} \quad \text{Angle } PRQ = 18^\circ$$

Given that angle  $PQR$  is obtuse,work out the area of triangle  $PQR$ 

Give your answer correct to 3 significant figures.

..... cm<sup>2</sup>

(Total for Question 23 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1HR

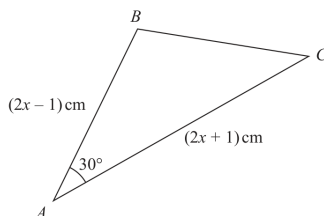
Session: May 2023

Q#: 25

Marks: 6

TOPIC: Sine, Cosine Rule &amp; Area of Triangles

Source: May 2023 P1HR | PDF pages: 26-27

25 Here is a triangle  $ABC$ Diagram NOT  
accurately drawnThe area of the triangle is  $(x^2 + x - 3.75) \text{ cm}^2$ Find the size of the largest angle in triangle  $ABC$   
Give your answer correct to the nearest degree......  
(Total for Question 25 is 6 marks)**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2023

Q#: 22

Marks: 5

TOPIC: Sine, Cosine Rule & Area of Triangles

Source: Jun 2023 P2H | PDF pages: 22-23

22 The diagram shows a triangle  $ABC$  and a flagpole  $BF$

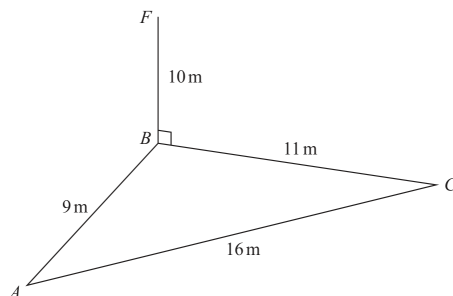


Diagram NOT accurately drawn

$A, B$  and  $C$  are points on horizontal ground.

$BF$  is vertical.

$$AB = 9\text{ m} \quad BC = 11\text{ m} \quad AC = 16\text{ m} \quad BF = 10\text{ m}$$

$D$  is the point on  $AC$  such that angle  $BDC = 90^\circ$

Work out the size of the angle of elevation of the point  $F$  from the point  $D$   
Give your answer correct to one decimal place.

(Total for Question 22 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jun 2025

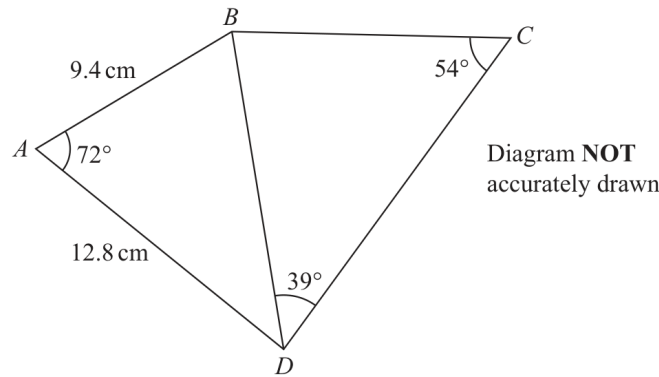
Q#: 20

Marks: 5

TOPIC: Sine, Cosine Rule &amp; Area of Triangles

Source: Jun 2025 P1H | PDF pages: 19-19

20



Work out the length of  $BC$   
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 20 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

## Topic 50

# 3D Pythagoras & Trigonometry

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### Geometry & Trigonometry

9 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jan 2021

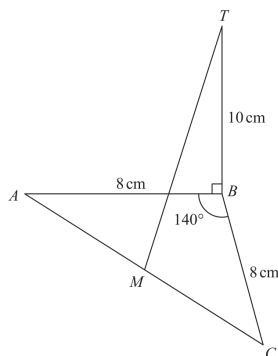
Q#: 22

Marks: 4

TOPIC: 3D Pythagoras &amp; Trigonometry

Source: Jan 2021 P2HR | PDF pages: 22-23

- 22  $ABC$  is an isosceles triangle in a horizontal plane.  
The point  $T$  is vertically above  $B$ .

Diagram **NOT**  
accurately drawn

Angle  $ABC = 140^\circ$   
 $AB = BC = 8$  cm  
 $TB = 10$  cm  
 $M$  is the midpoint of  $AC$ .

Calculate the size of the angle between  $MT$  and the horizontal plane  $ABC$ .  
 Give your answer correct to one decimal place.

..... °  
 (Total for Question 22 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May 2021

Q#: 22

Marks: 4

TOPIC: 3D Pythagoras & Trigonometry

Source: May 2021 P1H | PDF pages: 21-21

22 The diagram shows a triangular prism  $ABCDEF$  with a horizontal base  $ABEF$ .

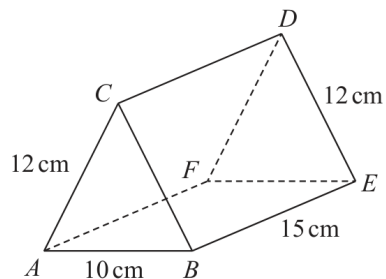


Diagram NOT accurately drawn

$$AC = BC = FD = ED = 12 \text{ cm} \quad AB = 10 \text{ cm} \quad BE = 15 \text{ cm}$$

Calculate the size of the angle between  $AD$  and the base  $ABEF$ .  
Give your answer correct to 3 significant figures.

(Total for Question 22 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed



*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2023

Q#: 22

Marks: 5

TOPIC: 3D Pythagoras & Trigonometry

Source: Jun 2023 P2HR | PDF pages: 22-23

22 Here is a cuboid  $ABCDEFGH$

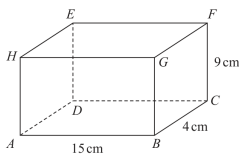


Diagram NOT accurately drawn

$AB = 15\text{ cm}$      $BC = 4\text{ cm}$      $CF = 9\text{ cm}$

- (a) Work out the length of  $BE$   
Give your answer correct to 3 significant figures.

..... cm  
(2)

Here is a cuboid  $PQRSTUWV$

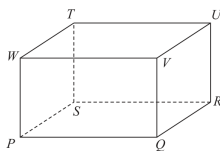


Diagram NOT accurately drawn

$PR = 42\text{ cm}$   
The size of the angle between  $PU$  and the plane  $PQRS$  is  $30^\circ$   
 $M$  is the midpoint of  $PR$

- (b) Work out the size of angle  $UMR$   
Give your answer correct to 3 significant figures.

.....  
(3)

(Total for Question 22 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: May 2024

Q#: 22

Marks: 6

TOPIC: 3D Pythagoras & Trigonometry

Source: May 2024 P1HR | PDF pages: 22-23

22 The diagram shows a cuboid  $ABCDEFGH$  with horizontal base  $ADEH$

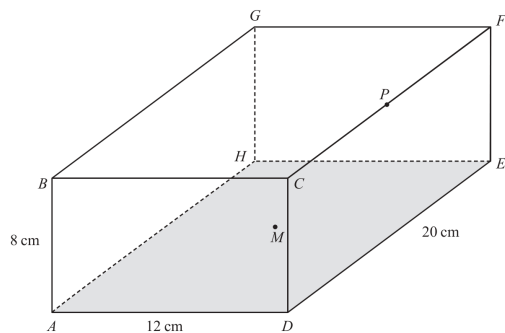


Diagram NOT accurately drawn

$AB = 8 \text{ cm}$        $AD = 12 \text{ cm}$        $DE = 20 \text{ cm}$

$M$  is the midpoint of the base  $ADEH$  and  $P$  is the midpoint of the edge  $CF$

Work out the size of angle  $BMP$   
Give your answer correct to one decimal place.

(Total for Question 22 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jun 2025

Q#: 20

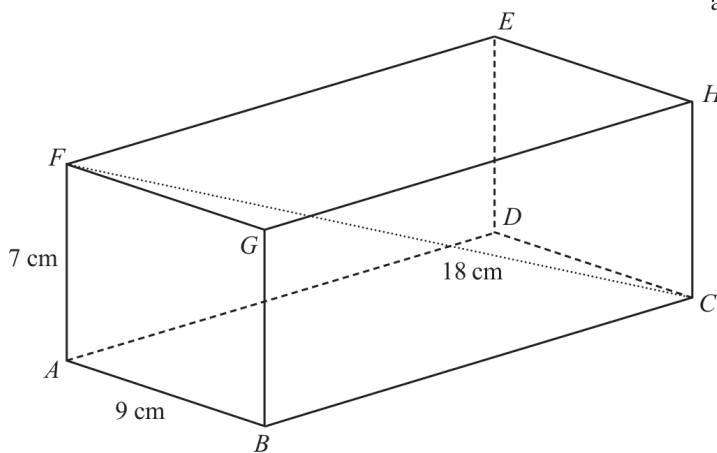
Marks: 3

TOPIC: 3D Pythagoras & Trigonometry

Source: Jun 2025 P1HR | PDF pages: 20-20

20 The diagram shows cuboid  $ABCDEFGH$

Diagram **NOT** accurately drawn



$AB = 9\text{ cm}$      $AF = 7\text{ cm}$      $FC = 18\text{ cm}$

Calculate the length of  $BC$   
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 20 is 3 marks)

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2025

Q#: 24

Marks: 4

TOPIC: 3D Pythagoras & Trigonometry

Source: Jun 2025 P2H | PDF pages: 22-23

24 The diagram shows a square-based pyramid  $ABCDE$

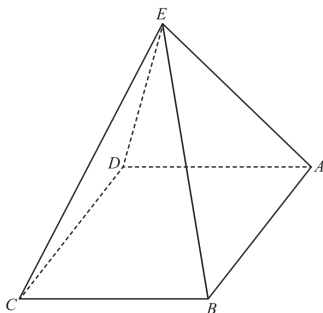


Diagram **NOT** accurately drawn

$EA = EB = EC = ED$

$M$  is the centre of the horizontal square base  $ABCD$

$Q$  is the midpoint of  $AB$

Angle  $EQM = 80^\circ$

$EA : AB = n : 1$

Find the value of  $n$

Give your answer correct to 3 significant figures.

$n = \dots\dots\dots$

(Total for Question 24 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2025

Q#: 23

Marks: 3

TOPIC: 3D Pythagoras & Trigonometry

Source: Jun 2025 P2HR | PDF pages: 23-23

23 The diagram shows a triangular prism,  $ABCDEF$ , with a horizontal rectangular base  $ABCD$

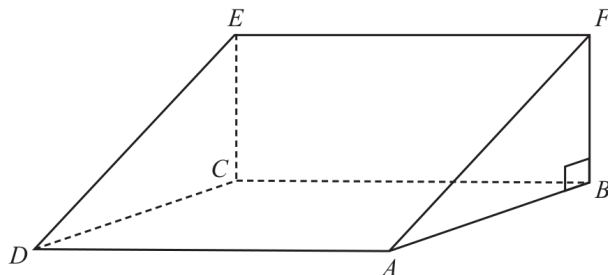


Diagram **NOT** accurately drawn

$M$  is the midpoint of the line  $AC$

$AC = 40\text{ cm}$     angle  $CAE = 35^\circ$     angle  $ABF = 90^\circ$

Work out the size of angle  $CME$

Give your answer correct to 3 significant figures.

.....<sup>o</sup>

(Total for Question 23 is 3 marks)

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2025

Q#: 26

Marks: 5

TOPIC: 3D Pythagoras & Trigonometry

Source: Nov 2025 P1H | PDF pages: 22-23

26 Here is a prism  $ABCDEFGH$  with a horizontal, rectangular base  $ABGF$

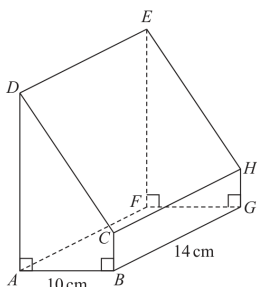


Diagram NOT accurately drawn

$AB = 10\text{ cm}$      $BG = 14\text{ cm}$

$\text{angle } DAB = \text{angle } ABC = \text{angle } EFG = \text{angle } FGH = 90^\circ$

$BC = \frac{1}{5}AD$

The angle of elevation of  $E$  from  $B$  is  $50^\circ$

Calculate the volume of the prism.  
Give your answer correct to 3 significant figures.  
Show your working clearly.

.....  $\text{cm}^3$

(Total for Question 26 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

## Unit V

# Vectors & Transformation Geometry

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Dr. Eslam Ahmed

## Topic 51

# Vectors

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### Vectors & Transformation Geometry

14 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2020

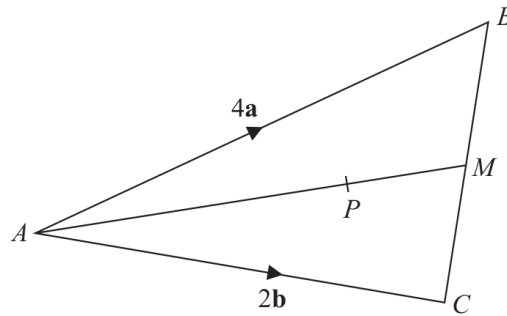
Q#: 23

Marks: 3

TOPIC: **Vectors**

Source: Jan 2020 P2H | PDF pages: 23-23

23

Diagram **NOT**  
accurately drawn

$ABC$  is a triangle.  
The midpoint of  $BC$  is  $M$ .  
 $P$  is a point on  $AM$ .

$$\vec{AB} = 4\mathbf{a}$$

$$\vec{AC} = 2\mathbf{b}$$

$$\vec{AP} = \frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b}$$

Find the ratio  $AP:PM$

.....  
(Total for Question 23 is 3 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

## CLASSIFIED PROBLEM

Paper: P2HR

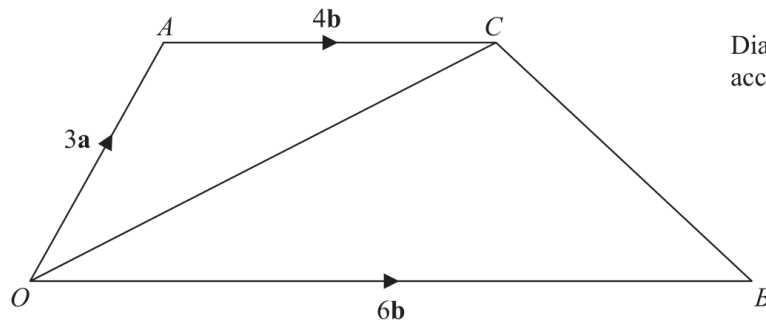
Session: Jan 2020

Q#: 26

Marks: 5

TOPIC: **Vectors**

Source: Jan 2020 P2HR | PDF pages: 26-26

26 The diagram shows trapezium  $OACB$ .Diagram **NOT**  
accurately drawn

$$\vec{OA} = 3\mathbf{a} \quad \vec{OB} = 6\mathbf{b} \quad \vec{AC} = 4\mathbf{b}$$

$N$  is the point on  $OC$  such that  $ANB$  is a straight line.

Find  $\vec{ON}$  as a simplified expression in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .

(Total for Question 26 is 5 marks)

## WORKED SOLUTION

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

## CLASSIFIED PROBLEM

Paper: P1H

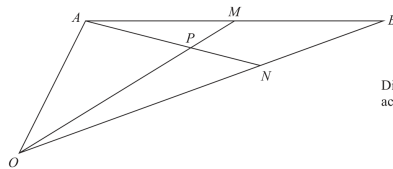
Session: Jan 2021

Q#: 23

Marks: 6

TOPIC: **Vectors**

Source: Jan 2021 P1H | PDF pages: 26-27

23  $OAB$  is a triangle.Diagram **NOT**  
accurately drawn

$$\vec{OA} = 2\mathbf{a} \text{ and } \vec{OB} = 2\mathbf{b}$$

 $M$  is the midpoint of  $AB$ . $N$  is the point on  $OB$  such that  $ON:NB = 2:1$  $P$  is the point on  $AN$  such that  $OPM$  is a straight line.Use a vector method to find  $OP:PM$   
Show your working clearly.

(Total for Question 23 is 6 marks)

## WORKED SOLUTION

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

## CLASSIFIED PROBLEM

Paper: P1H

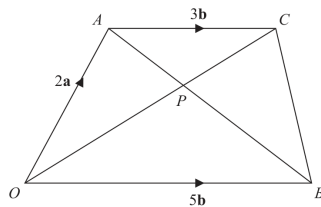
Session: May 2021

Q#: 26

Marks: 5

TOPIC: **Vectors**

Source: May 2021 P1H | PDF pages: 26-27

26  $OACB$  is a trapezium.Diagram **NOT**  
accurately drawn

$$\vec{OA} = 2\mathbf{a} \quad \vec{OB} = 5\mathbf{b} \quad \vec{AC} = 3\mathbf{b}$$

The diagonals,  $OC$  and  $AB$ , of the trapezium intersect at the point  $P$ .Find and simplify an expression, in terms of  $\mathbf{a}$  and  $\mathbf{b}$ , for  $\vec{OP}$ .  
Show your working clearly.

$$\vec{OP} = \dots\dots\dots$$

(Total for Question 26 is 5 marks)

## WORKED SOLUTION

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

## CLASSIFIED PROBLEM

Paper: P1H

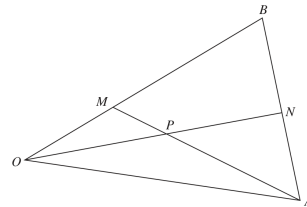
Session: Jan 2022

Q#: 22

Marks: 5

TOPIC: **Vectors**

Source: Jan 2022 P1H | PDF pages: 24-25

22 The diagram shows triangle  $OAB$ Diagram **NOT**  
accurately drawn

$$\vec{OA} = 8\mathbf{a} \quad \vec{OB} = 6\mathbf{b}$$

$M$  is the point on  $OB$  such that  $OM:MB = 1:2$   
 $N$  is the midpoint of  $AB$   
 $P$  is the point of intersection of  $ON$  and  $AM$

Using a vector method, find  $\vec{OP}$  as a simplified expression in terms of  $\mathbf{a}$  and  $\mathbf{b}$   
 Show your working clearly.

$$\vec{OP} = \underline{\hspace{2cm}}$$

(Total for Question 22 is 5 marks)

## WORKED SOLUTION

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

## CLASSIFIED PROBLEM

Paper: P1HR

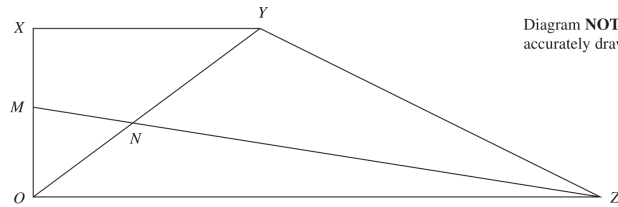
Session: Jan 2022

Q#: 24

Marks: 5

TOPIC: Vectors

Source: Jan 2022 P1HR | PDF pages: 30-31

24  $OXYZ$  is a trapezium.Diagram NOT  
accurately drawn

$$\vec{OX} = \mathbf{a}$$

$$\vec{XY} = \mathbf{b}$$

$$\vec{OZ} = 3\mathbf{b}$$

 $M$  is the midpoint of  $OX$  $N$  is the point such that  $MNZ$  and  $ONY$  are straight lines.Given that  $ON : OY = \lambda : 1$ use a vector method to find the value of  $\lambda$ .

$$\lambda = \dots\dots\dots$$

(Total for Question 24 is 5 marks)

## WORKED SOLUTION

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

## CLASSIFIED PROBLEM

Paper: P2H

Session: Jun 2022

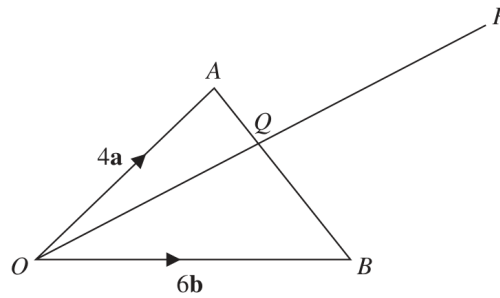
Q#: 21

Marks: 5

TOPIC: **Vectors**

Source: Jun 2022 P2H | PDF pages: 21-21

21

Diagram **NOT**  
accurately drawn $OAB$  is a triangle. $Q$  is the point on  $AB$  such that  $OQP$  is a straight line.

$$\vec{OA} = 4\mathbf{a} \quad \vec{OB} = 6\mathbf{b} \quad \vec{AP} = 2\mathbf{a} + 8\mathbf{b}$$

Using a vector method, find the ratio  $AQ:QB$ 

$$AQ:QB = \dots\dots\dots$$

(Total for Question 21 is 5 marks)

## WORKED SOLUTION

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2022

Q#: 25

Marks: 5

TOPIC: **Vectors**

Source: Jun 2022 P2HR | PDF pages: 28-28

25  $ABCD$  is a parallelogram and  $ADM$  is a straight line.

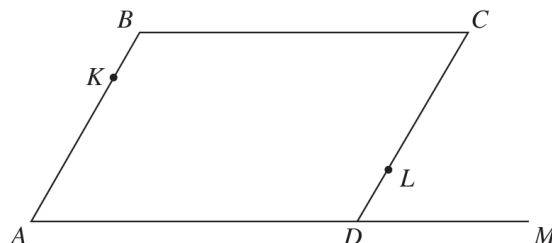


Diagram NOT  
accurately drawn

$$\vec{AB} = \mathbf{a} \quad \vec{BC} = \mathbf{b} \quad \vec{DM} = \frac{1}{2} \mathbf{b}$$

$K$  is the point on  $AB$  such that  $AK:AB = \lambda:1$

$L$  is the point on  $CD$  such that  $CL:CD = \mu:1$

$KLM$  is a straight line.

Given that  $\lambda:\mu = 1:2$

use a vector method to find the value of  $\lambda$  and the value of  $\mu$

$$\lambda = \dots\dots\dots$$

$$\mu = \dots\dots\dots$$

(Total for Question 25 is 5 marks)

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2023

Q#: 22

Marks: 5

TOPIC: **Vectors**

Source: Nov 2023 P2H | PDF pages: 20-21

22

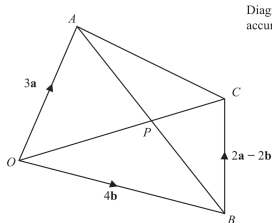


Diagram NOT accurately drawn

$OACB$  is a quadrilateral.

$\vec{OA} = 3\mathbf{a}$     $\vec{OB} = 4\mathbf{b}$     $\vec{BC} = 2\mathbf{a} - 2\mathbf{b}$

(a) (i) Find the vector  $\vec{OC}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .  
Simplify your answer.

$\vec{OC} =$  \_\_\_\_\_ (1)

(ii) Find the vector  $\vec{AB}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$

$\vec{AB} =$  \_\_\_\_\_ (1)

The point  $P$  lies on  $AB$  and on  $OC$

(b) Using a vector method, find the ratio  $AP : PB$ .  
Show your working clearly.

(3)

(Total for Question 22 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2024

Q#: 24

Marks: 6

TOPIC: **Vectors**

Source: Jun 2024 P2H | PDF pages: 24-25

24

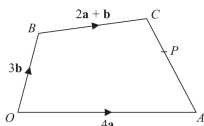


Diagram NOT accurately drawn

The diagram shows a quadrilateral  $OACB$  in which

$$\vec{OA} = 4\mathbf{a} \quad \vec{OB} = 3\mathbf{b} \quad \vec{BC} = 2\mathbf{a} + \mathbf{b}$$

- (a) Find  $\vec{AC}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$   
Give your answer in its simplest form.

$$\vec{AC} = \text{-----} \quad (2)$$

- The point  $P$  lies on  $AC$  such that  $AP:PC = 3:2$   
The point  $Q$  is such that  $OPQ$  and  $BCQ$  are straight lines.  
(b) Using a vector method, find  $\vec{OQ}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$   
Give your answer in its simplest form.  
Show your working clearly.

$$\vec{OQ} = \text{-----} \quad (4)$$

(Total for Question 24 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2024

Q#: 25

Marks: 6

TOPIC: **Vectors**

Source: Jun 2024 P2HR | PDF pages: 28-29

25  $OPQR$  is a parallelogram.

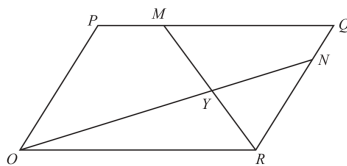


Diagram NOT accurately drawn

$\vec{OP} = 2\mathbf{a}$  and  $\vec{OR} = 3\mathbf{b}$

The point  $M$  lies on  $PQ$  such that  $PM = \frac{1}{4}PQ$

The point  $N$  lies on  $RQ$  such that  $RN = \frac{4}{5}RQ$

(a) Find, in terms of  $\mathbf{a}$  and  $\mathbf{b}$ , giving your answers in simplest form

(i)  $\vec{ON}$

.....  
(1)

(ii)  $\vec{MR}$

.....  
(1)

$MR$  and  $ON$  intersect at the point  $Y$

Given that

$OY = k \times ON$

(b) use a vector method to find the value of  $k$

$k =$  .....  
(4)

(Total for Question 25 is 6 marks)

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2024

Q#: 24

Marks: 6

TOPIC: **Vectors**

Source: Nov 2024 P1H | PDF pages: 26-27

24  $OAB$  is a triangle.

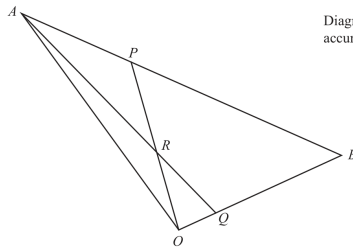


Diagram NOT accurately drawn

$$\vec{OA} = 10\mathbf{a} \quad \vec{OB} = 10\mathbf{b}$$

$ARQ$  and  $ORP$  are straight lines.

$$\vec{AP} = \frac{1}{4} \vec{AB} \quad \text{and} \quad \vec{OQ} = \frac{1}{5} \vec{OB}$$

Write the following vectors in terms of  $\mathbf{a}$  and  $\mathbf{b}$   
Simplify your answers.

(i)  $\vec{AQ}$

\_\_\_\_\_ (1)

(ii)  $\vec{OP}$

\_\_\_\_\_ (1)

(iii)  $\vec{OR}$

\_\_\_\_\_ (4)

(Total for Question 24 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jun 2025

Q#: 23

Marks: 5

TOPIC: **Vectors**

Source: Jun 2025 P1H | PDF pages: 22-23

23

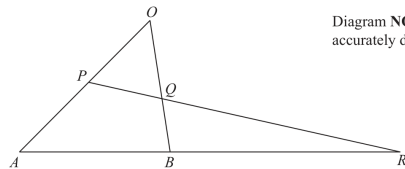


Diagram NOT accurately drawn

$OAB$  is a triangle.  
 $P$  is the midpoint of  $OA$   
 $Q$  is a point on  $OB$

$ABR$  and  $PQR$  are straight lines.

$$\vec{OA} = 12\mathbf{a} \quad \vec{OB} = 8\mathbf{b}$$

(a) Express  $\vec{AB}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$

(1)

$$AB:BR = 1:2 \quad \vec{OQ} = n\mathbf{b}$$

(b) Use a vector method to find the value of  $n$

$$n = \dots \dots \dots (4)$$

(Total for Question 23 is 5 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2025

Q#: 27

Marks: 6

TOPIC: **Vectors**

Source: Nov 2025 P1H | PDF pages: 24-25

27

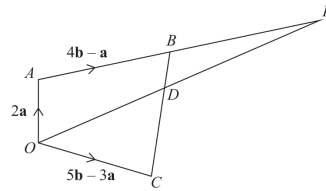


Diagram NOT accurately drawn

$OABC$  is a quadrilateral.  
 $ABP$  and  $ODP$  are straight lines.

$$\vec{OA} = 2\mathbf{a} \quad \vec{AB} = 4\mathbf{b} - \mathbf{a} \quad \vec{OC} = 5\mathbf{b} - 3\mathbf{a}$$

- (a) Find an expression in terms of  $\mathbf{a}$  and  $\mathbf{b}$  for the vector  $\vec{BC}$   
 Simplify your answer.

(2)

The point  $D$  lies on  $BC$  such that  $BD:DC = 1:3$

Given that  $\vec{OP} = n\vec{OD}$

- (b) use a vector method to find the value of  $n$

$n =$  .....  
 (4)

(Total for Question 27 is 6 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

## Topic 52

# Transformations

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### Vectors & Transformation Geometry

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Unit VI

# Statistics & Probability

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Dr. Eslam Ahmed

## Topic 53

# Statistics Toolkit

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### Statistics & Probability

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 54

# Histograms

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### Statistics & Probability

7 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jan 2022

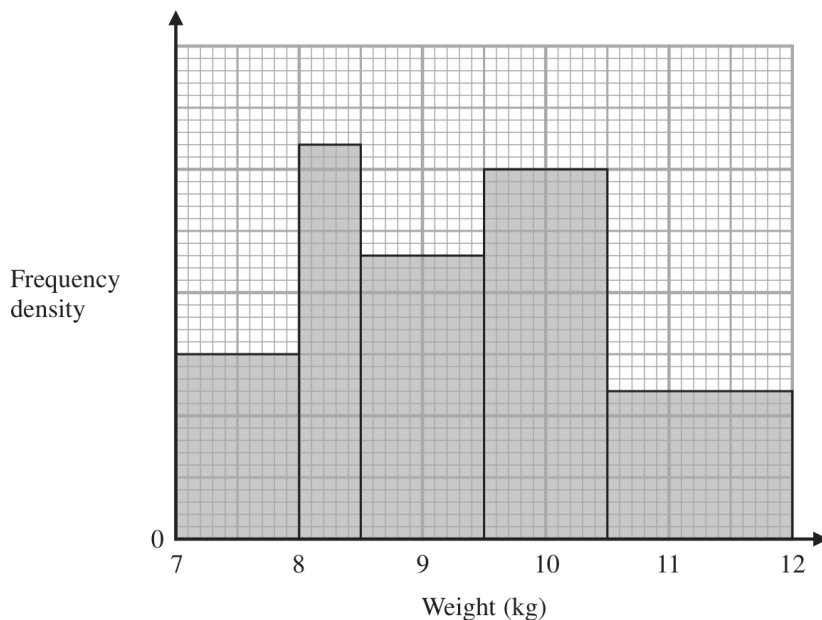
Q#: 21

Marks: 3

TOPIC: Histograms

Source: Jan 2022 P1HR | PDF pages: 26-26

21



The histogram gives information about the weights, in kg, of all the watermelons in a field.

There are 16 watermelons with a weight between 8 kg and 8.5 kg

Work out the total number of watermelons in the field.

(Total for Question 21 is 3 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jan 2022

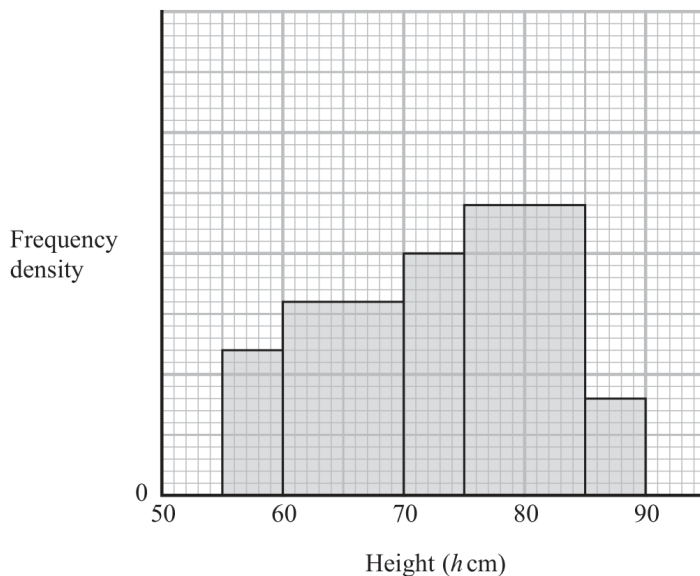
Q#: 20

Marks: 4

TOPIC: Histograms

Source: Jan 2022 P2H | PDF pages: 22-22

20 The histogram gives information about the heights,  $h$  cm, of some tomato plants.



There are 12 tomato plants for which  $75 < h \leq 85$

One of the tomato plants is selected at random.

Find an estimate for the probability that this tomato plant has a height greater than 82.5 cm

(Total for Question 20 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jun 2022

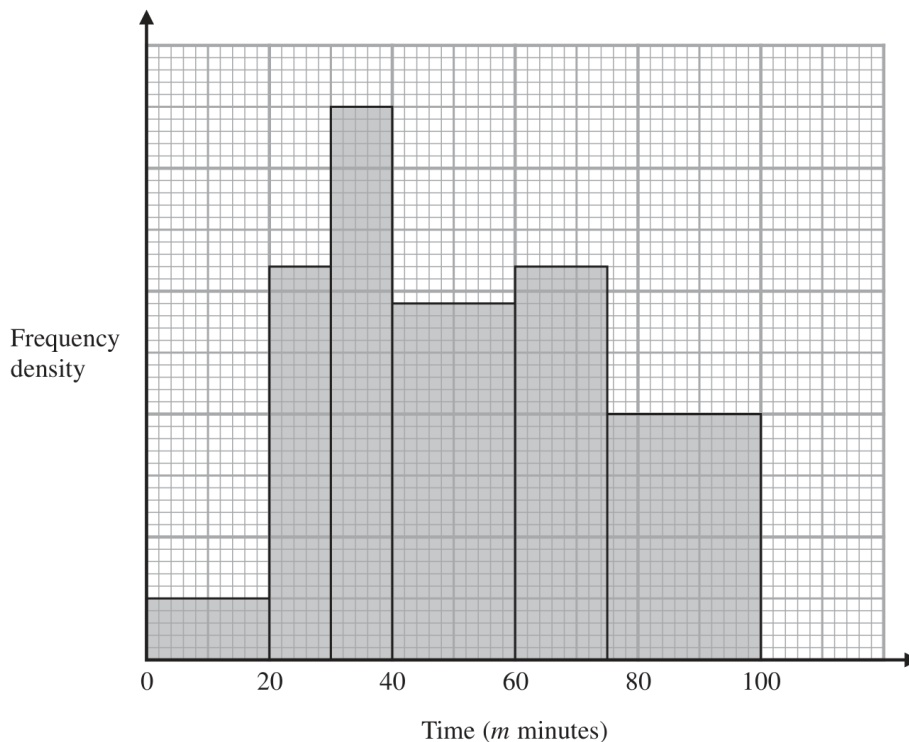
Q#: 21

Marks: 3

TOPIC: Histograms

Source: Jun 2022 P1H | PDF pages: 22-22

- 21 The histogram shows information about the total time,  $m$  minutes, taken by each child in a school to walk to school every day for one week.



There are no children for whom  $m > 100$

There are 10 children for whom  $m \leq 20$

Work out an estimate for the number of children for whom  $50 < m \leq 80$

(Total for Question 21 is 3 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: May 2023

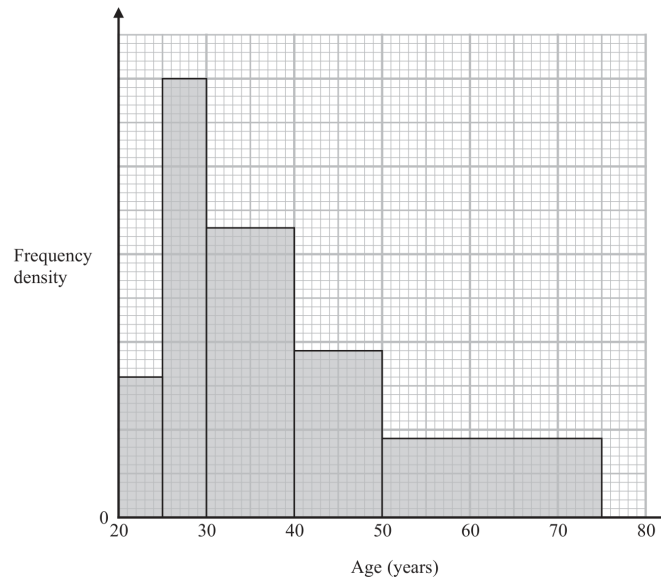
Q#: 22

Marks: 4

TOPIC: Histograms

Source: May 2023 P1HR | PDF pages: 22-23

22 Some people attend a concert.  
The histogram shows information about the ages of these people.



Work out an estimate for the percentage of these people who are aged more than 55 years.  
Give your answer correct to one decimal place.

.....%

(Total for Question 22 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: May 2024

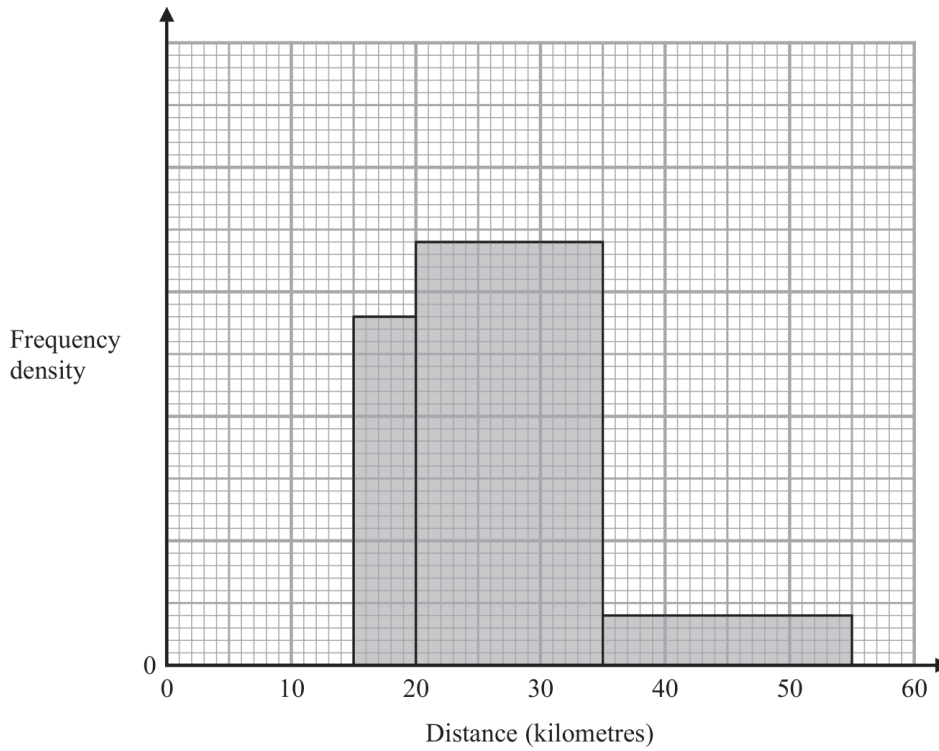
Q#: 22

Marks: 3

TOPIC: Histograms

Source: May 2024 P1H | PDF pages: 23-23

22 The incomplete histogram shows some information about the distances, in kilometres, that 100 adults ran last week.



All of the adults ran at least 5 kilometres.  
 None of the adults ran more than 55 kilometres.  
 14 adults ran between 15 kilometres and 20 kilometres.

Complete the histogram.

(Total for Question 22 is 3 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jun 2025

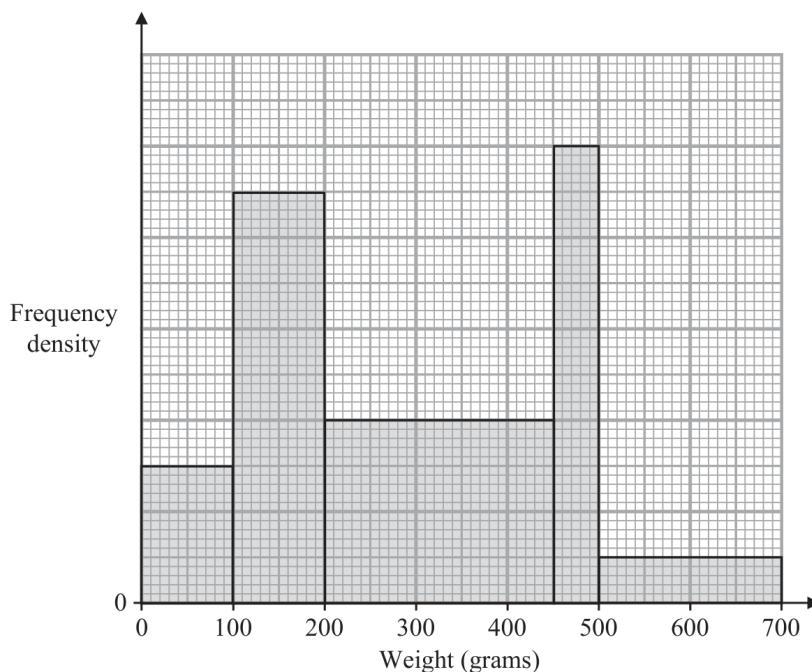
Q#: 20

Marks: 4

TOPIC: Histograms

Source: Jun 2025 P2HR | PDF pages: 20-20

20 The histogram gives some information about the weights, in grams, of some books.



75 books weigh less than 100 grams.

A book is chosen at random.

Find an estimate for the probability that this book weighs between 400 grams and 600 grams.

(Total for Question 20 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Nov 2025

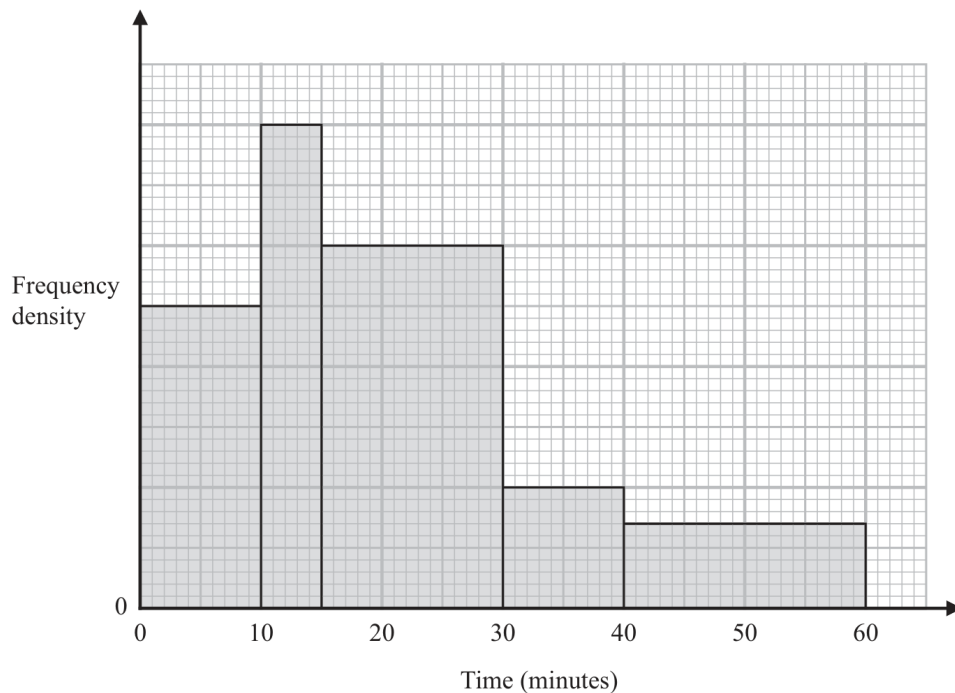
Q#: 21

Marks: 3

TOPIC: Histograms

Source: Nov 2025 P2H | PDF pages: 21-21

- 21 The histogram shows information about the times, in minutes, that some trains arrived late at a station one day.



20 of these trains arrived between 10 minutes late and 15 minutes late.

No trains arrived more than 60 minutes late.

Work out an estimate for the number of these trains that arrived at least 25 minutes late.

(Total for Question 21 is 3 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

## Topic 55

# Cumulative Frequency Diagrams

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### Statistics & Probability

0 classified problem(s) in this topic.

No whole exam question was classified into this topic from the selected papers.

Dr. Eslam Ahmed

## Topic 56

# Probability Toolkit

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### Statistics & Probability

7 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: May-Nov 2020

Q#: 23

Marks: 4

TOPIC: Probability Toolkit

Source: May-Nov 2020 P1HR | PDF pages: 24-24

23 In a bag, there are only

3 blue beads  
4 white beads  
and  $x$  orange beads.

Jean is going to take at random two beads from the bag.

The probability that Jean will take two beads of the same colour is  $\frac{3}{8}$

Find the total number of beads in the bag.  
Show clear algebraic working.

.....  
(Total for Question 23 is 4 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2HR

Session: Jan 2021

Q#: 21

Marks: 6

TOPIC: Probability Toolkit

Source: Jan 2021 P2HR | PDF pages: 20-21

- 21 A bag contains  $n$  beads.  
6 of the beads are red and the rest are blue.  
Ravi is going to take at random 2 beads from the bag.  
The probability that the 2 beads will be of the same colour is  $\frac{9}{17}$   
Using algebra, and showing each stage of your working, calculate the value of  $n$ .

 $n = \dots\dots\dots$ **(Total for Question 21 is 6 marks)****WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P2H

Session: May 2021

Q#: 23

Marks: 5

TOPIC: **Probability Toolkit**

Source: May 2021 P2H | PDF pages: 26-27

23 Pippa has a box containing  $N$  pens.

There are only black pens and red pens in the box.

The number of black pens in the box is 3 more than the number of red pens.

Pippa is going to take at random 2 pens from the box.

The probability that she will take a black pen **followed** by a red pen is  $\frac{9}{35}$

Find the possible values of  $N$ .

Show clear algebraic working.

(Total for Question 23 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: Jun 2022

Q#: 24

Marks: 5

TOPIC: Probability Toolkit

Source: Jun 2022 P1HR | PDF pages: 27-27

**24** Elliot has  $x$  counters.

Each counter has one red face and one green face.

Elliot spreads all the counters out on a table and sees that the number of counters showing a red face is 5

Elliot then picks at random one of the counters and turns the counter over. He then picks at random a second counter and turns the counter over.

The probability that there are still 5 counters showing a red face is  $\frac{19}{32}$ Work out the value of  $x$   
Show clear algebraic working. $x = \dots\dots\dots$ **(Total for Question 24 is 5 marks)****WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2023

Q#: 20

Marks: 4

TOPIC: Probability Toolkit

Source: Nov 2023 P1H | PDF pages: 23-23

**20** A bag contains only 10 cent coins and 20 cent coins.

Josip takes at random a coin from the bag, records its value and replaces it in the bag. He then takes at random a second coin from the bag, records its value and replaces it in the bag.

Josip finds the mean value of the two coins.

The probability that the two coins have a mean value of 10 cents is  $\frac{49}{121}$

Work out the probability that the two coins have a mean value of 15 cents.

.....  
(Total for Question 20 is 4 marks)

**WORKED SOLUTION**

Dr. Eslam Ahmed

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1HR

Session: May 2024

Q#: 21

Marks: 5

TOPIC: **Probability Toolkit**

Source: May 2024 P1HR | PDF pages: 21-21

21 There are 25 counters in a bag such that

6 counters are blue

$x$  counters are orange, where  $x > 9$

the rest of the counters are pink

Maalam takes at random two of the counters from the bag.

The probability that Maalam takes one orange counter and one pink counter is  $\frac{22}{75}$

Calculate the probability that Maalam takes 2 pink counters from the bag.  
Show clear algebraic working.

.....  
(Total for Question 21 is 5 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Jun 2025

Q#: 21

Marks: 3

TOPIC: **Probability Toolkit**

Source: Jun 2025 P1H | PDF pages: 20-20

**21** A box contains 20 counters.

9 of the counters are red

7 of the counters are yellow

4 of the counters are green

Alex takes at random three counters from the box.

Work out the probability that exactly two of the three counters are the same colour.

.....  
(Total for Question 21 is 3 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

## Topic 57

# Probability Diagrams - Venn & Tree Diagrams

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### Statistics & Probability

1 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2025

Q#: 20

Marks: 6

TOPIC: Probability Diagramms - Venn & Tree Diagramms

Source: Jun 2025 P2H | PDF pages: 18-18

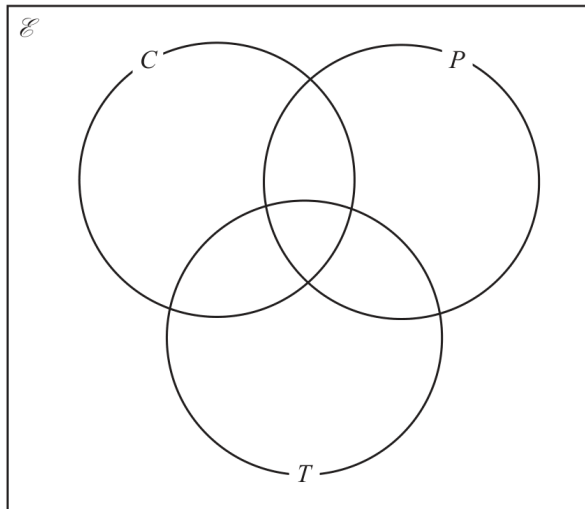
20 120 gardeners were asked if they grow carrots ( $C$ ) or potatoes ( $P$ ) or tomatoes ( $T$ )

Of these gardeners

- 43 grow carrots
- 12 grow carrots and potatoes and tomatoes
- 18 grow carrots and potatoes
- 27 grow carrots and tomatoes
- 32 grow potatoes and tomatoes
- 29 do not grow carrots or potatoes or tomatoes

The number of these gardeners who grow only potatoes is equal to the number of these gardeners who grow only tomatoes.

(a) Complete the Venn diagram to show this information.



(3)

(b) Find  $n(T' \cap C)$

.....  
(1)

One of the gardeners who grows carrots is chosen at random.

(c) Calculate the probability that this gardener also grows potatoes.

.....  
(2)

**(Total for Question 20 is 6 marks)**

**WORKED SOLUTION**

*Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

## Topic 58

# Combined & Conditional Probability

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### Statistics & Probability

2 classified problem(s) in this topic.

Dr. Eslam Ahmed

**CLASSIFIED PROBLEM**

Paper: P2H

Session: Jun 2023

Q#: 20

Marks: 3

TOPIC: **Combined & Conditional Probability**

Source: Jun 2023 P2H | PDF pages: 20-20

**20** There are 12 counters in a bag.

3 of the counters are red

9 of the counters are green

Ameya, Jack and Ella each take at random one counter from the bag.

Work out the probability that at least one red counter is still in the bag.

.....  
(Total for Question 20 is 3 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

*Dr. Eslam Ahmed*

**CLASSIFIED PROBLEM**

Paper: P1H

Session: Nov 2025

Q#: 22

Marks: 3

TOPIC: **Combined & Conditional Probability**

Source: Nov 2025 P1H | PDF pages: 18-18

22 There are 15 buttons in a box.

- 3 of the buttons are red
- 2 of the buttons are pink
- 10 of the buttons are blue

Pete takes at random three buttons from the box.

Work out the probability that there is still at least one pink button in the box.

.....  
(Total for Question 22 is 3 marks)

**WORKED SOLUTION***Dr. Eslam Ahmed*

*Worked solution by Dr. Eslam Ahmed – forthcoming.*

Dr. Eslam Ahmed