Elite Mathematics
Pearson Edexcel International GCSE

IGCSE LINEAR · 4MA1

4WM1/01 Specimen Worked Solutions

Specimen 0 paper rebuilt with the worked solution after each question.

23	2020–2026	Single-paper solutions
paper questions	52 past papers	checked by Dr Eslam



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PAST PAPER

4WM1/01 Specimen

Specimen 0

23	100	2 h
questions	marks	exam time

Each question is followed by its worked solution and final answer.

4WM1/01 SPECIMEN

Question 1

1 marks | Rounding, Estimation & Bounds

1 The weight of a cake is 2.75 kg, correct to 2 decimal places.

Write down the lower bound of the weight of the cake.

..... kg

(Total for Question 1 is 1 mark)

WORKED SOLUTION

Question 1 · 4WM1/01 Specimen

1 Find half the rounding interval

Correct to 2 decimal places means the nearest 0.01 kg.

$$\frac{0.01}{2} = 0.005$$

2 Subtract from the rounded value

$$2.75 - 0.005 = 2.745$$

FINAL ANSWER

2.745 kg.

4WM1/01 SPECIMEN

Question 2

3 marks | Fractions

2 Show that $5\frac{1}{3} - 2\frac{6}{7} = 2\frac{10}{21}$

(Total for Question 2 is 3 marks)

WORKED SOLUTION

Question 2 · 4WM1/01 Specimen

1 Convert to improper fractions

$$5\frac{1}{3} = \frac{16}{3}, \qquad 2\frac{6}{7} = \frac{20}{7}$$

2 Use a common denominator

$$\frac{16}{3} - \frac{20}{7} = \frac{112}{21} - \frac{60}{21} = \frac{52}{21}$$

3 Convert back to a mixed number

$$\frac{52}{21} = 2\frac{10}{21}$$

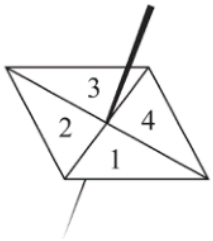
FINAL ANSWER

$2\frac{10}{21}$.

Question 3

4 marks | Probability Toolkit

3 Here is a biased 4-sided spinner.



The table gives the probabilities that, when the spinner is spun once, it will land on 1 or it will land on 3

Number	1	2	3	4
Probability	0.26		0.18	

The probability that the spinner will land on 2 is equal to the probability that the spinner will land on 4

Priya is going to spin the spinner 250 times.

Work out an estimate for the number of times the spinner will land on a 1 or a 2

.....

(Total for Question 3 is 4 marks)

1 **Find the remaining probability**

$$1 - 0.26 - 0.18 = 0.56$$

2 **Split the equal probabilities**

The probabilities for 2 and 4 are equal, so

$$P(2) = P(4) = \frac{0.56}{2} = 0.28$$

3 **Find the probability of 1 or 2**

$$P(1 \text{ or } 2) = 0.26 + 0.28 = 0.54$$

4 **Calculate the estimate**

$$0.54 \times 250 = 135$$

✓ **FINAL ANSWER**

135.

4WM1/01 SPECIMEN

Question 4

5 marks | Linear Equations

4 (a) Expand and simplify $(n - 6)(n + 4)$

.....

(2)

(b) Solve $2x - 3 = \frac{3x - 5}{4}$

Show clear algebraic working.

$x =$ .....

(3)

(Total for Question 4 is 5 marks)

1 **Expand the brackets**

$$(n-6)(n+4) = n^2 + 4n - 6n - 24$$

$$= n^2 - 2n - 24$$

2 **Clear the denominator**

$$2x - 3 = \frac{3x - 5}{4}$$

$$4(2x - 3) = 3x - 5$$

3 **Solve the equation**

$$8x - 12 = 3x - 5$$

$$5x = 7$$

$$x = \frac{7}{5}$$

✓ **FINAL ANSWER**

$n^2 - 2n - 24$, and $x = \frac{7}{5}$.

4WM1/01 SPECIMEN

Question 5

3 marks | Standard & Compound Units

5 A plane flies from New York City to Los Angeles.

The plane flies a distance of 3980 kilometres in 5 hours 24 minutes.

Work out the average speed of the plane.
Give your answer in kilometres per hour correct to the nearest whole number.

..... kilometres per hour

(Total for Question 5 is 3 marks)

WORKED SOLUTION

Question 5 · 4WM1/01 Specimen

1 Convert the time

$$24 \text{ minutes} = \frac{24}{60} = 0.4 \text{ hours}$$

$$5 \text{ hours } 24 \text{ minutes} = 5.4 \text{ hours}$$

2 Calculate the speed

$$\text{speed} = \frac{3980}{5.4} = 737.037\ldots$$

3 Round the answer

$$737.037\ldots \approx 737$$

FINAL ANSWER

737 kilometres per hour.

Question 6

4 marks | Perimeter & Area

6 The diagram shows an 8-sided shape *ABCDEFGH*

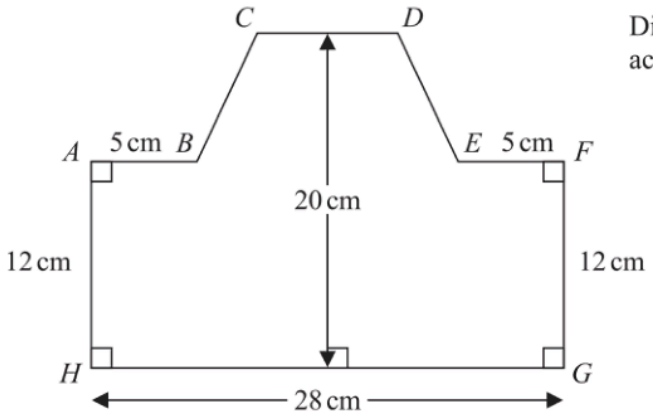


Diagram **NOT** accurately drawn

$HG = 28\,\text{cm}$ $AH = FG = 12\,\text{cm}$ $AB = EF = 5\,\text{cm}$
The height of the shape is 20 cm
CD is parallel to *HG*

The area of shape *ABCDEFGH* is $434\,\text{cm}^2$

Find the length of *CD*

1 Find the rectangular part

The rectangle at the bottom has width 28 cm and height 12 cm.

$$28 \times 12 = 336$$

2 Find the top area

$$434 - 336 = 98$$

3 Set up the trapezium

The top trapezium has height

$$20 - 12 = 8$$

Its lower parallel side is

$$28 - 5 - 5 = 18$$

4 Solve for the missing length

Let $CD = x$.

$$\frac{1}{2}(x + 18) \times 8 = 98$$

$$4(x + 18) = 98$$

$$x = 6.5$$

FINAL ANSWER

$CD = 6.5$ cm.

4WM1/01 SPECIMEN

Question 7

4 marks | Algebraic Roots & Indices

7 (a) Simplify $8 \times (4t)^0$

.....

(1)

$x^6 \div x^{-5} = x^p$

(b) Find the value of p

$p =$ .....

(1)

(c) Simplify fully $(2k^2m^4)^3$

.....

(2)

WORKED SOLUTION

Question 7 · 4WM1/01 Specimen

1 Use the zero power

$$(4t)^0 = 1$$

$$8(4t)^0 = 8$$

2 Subtract the indices

$$x^6 \div x^{-5} = x^{6-(-5)} = x^{11}$$

So $p = 11$.

3 **Raise each factor to the power**

$$(2k^2m^4)^3 = 2^3k^{2\times3}m^{4\times3}$$

$$= 8k^6m^{12}$$

✓ **FINAL ANSWER**

8, $p = 11$, and $8k^6m^{12}$.

4WM1/01 SPECIMEN

Question 8

3 marks | Standard & Compound Units

(Total for Question 7 is 4 marks)

8 Change a speed of 81 kilometres per hour to a speed in metres per second.

..... metres per second

(Total for Question 8 is 3 marks)

WORKED SOLUTION

Question 8 · 4WM1/01 Specimen

1 Convert kilometres to metres

$$81 \text{ km} = 81000 \text{ m}$$

2 Convert hours to seconds

$$1 \text{ hour} = 3600 \text{ seconds}$$

3 Divide to find metres per second

$$\frac{81000}{3600} = 22.5$$

FINAL ANSWER

22.5 metres per second.

Question 9

7 marks | Linear Graphs

9 (a) Simplify $3a^4b^5 \times 4a^7b^2$

.....

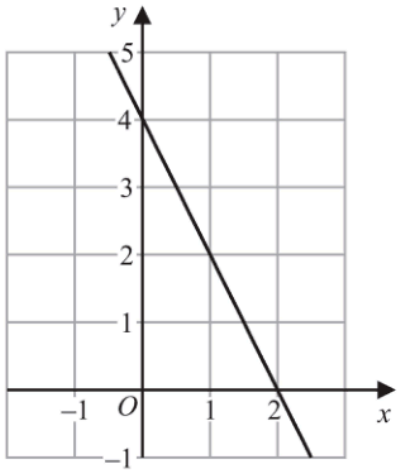
(2)

(b) Factorise fully $14x^2y^4 + 21x^3y^2$

.....

(2)

The diagram shows a straight line drawn on a grid.



(c) Find an equation of the line.

.....

(2)

A different straight line has equation $y = 3x - 5$

(d) Write down the coordinates of the point at which the line crosses the y-axis.

(....., ...)

(1)

(Total for Question 9 is 7 marks)

1 **Simplify the product**

$$3a^4b^5 \times 4a^7b^2 = 12a^{11}b^7$$

2 **Factorise fully**

$$14x^2y^4 + 21x^3y^2 = 7x^2y^2(2y^2 + 3x)$$

3 **Find the gradient**

The line passes through $(0, 4)$ and $(2, 0)$.

$$m = \frac{0 - 4}{2 - 0} = -2$$

4 **Write the equation**

The y-intercept is 4, so

$$y = -2x + 4$$

5 **Read the y-axis crossing**

For $y = 3x - 5$, put $x = 0$:

$$y = -5$$

So the crossing point is $(0, -5)$.

✓ **FINAL ANSWER**

$12a^{11}b^7$, $7x^2y^2(2y^2 + 3x)$, $y = -2x + 4$, and $(0, -5)$.

Question 10

6 marks | Right-Angled Triangles - Pythagoras & Trigonometry

10 The diagram shows a quadrilateral $ABCD$

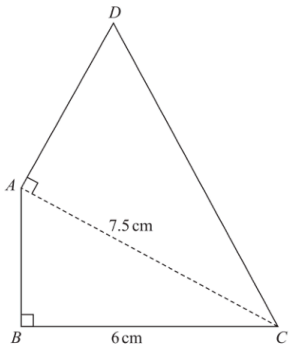


Diagram **NOT** accurately drawn

In the diagram, ABC and DAC are right-angled triangles.

$BC = 6$ cm $\quad AC = 7.5$ cm

The area of quadrilateral $ABCD$ is 31.5 cm^2

(a) Work out the length of AB

..... cm

(2)

(b) Work out the length of AD

..... cm

(4)

(Total for Question 10 is 6 marks)

1 **Use Pythagoras for AB**

In triangle ABC,

$$AB^2 + 6^2 = 7.5^2$$

$$AB^2 = 56.25 - 36 = 20.25$$

$$AB = 4.5$$

2 **Find the area of triangle ABC**

$$\frac{1}{2} \times 6 \times 4.5 = 13.5$$

3 **Find the area of triangle DAC**

$$31.5 - 13.5 = 18$$

4 **Use the triangle area formula**

In triangle DAC, AD and AC are perpendicular.

$$\frac{1}{2} \times AD \times 7.5 = 18$$

$$AD = \frac{36}{7.5} = 4.8$$

✓ **FINAL ANSWER**

$AB = 4.5$ cm, $AD = 4.8$ cm.

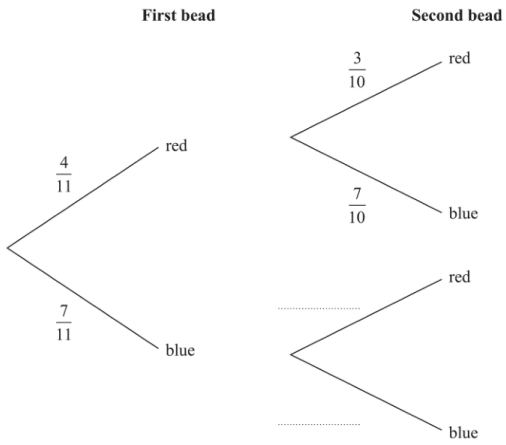
Question 11

6 marks | Tree Diagrams & Conditional Probability

11 Tess has a bag containing 11 beads.
4 of the beads are red.
7 of the beads are blue.

Tess takes at random a bead from the bag and keeps it.
Tess takes at random another bead from the bag and keeps it.

(a) Complete the probability tree diagram.



(1)

(b) Work out the probability that both of the beads are red.

.....

(2)

(c) Work out the probability that the two beads are of different colours.

.....

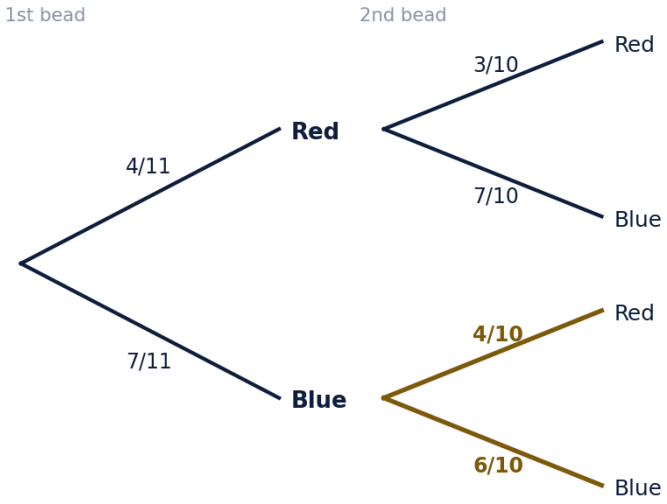
(3)

(Total for Question 11 is 6 marks)

1 Complete the blue-first branch

After a blue bead is taken first, there are 4 red and 6 blue beads left out of 10.

$$P(\text{red second after blue}) = \frac{4}{10}, \qquad P(\text{blue second after blue}) = \frac{6}{10}$$



2 Find both red

$$P(RR) = \frac{4}{11} \times \frac{3}{10} = \frac{12}{110} = \frac{6}{55}$$

3 Find different colours

$$P(RB) = \frac{4}{11} \times \frac{7}{10}$$

$$P(BR) = \frac{7}{11} \times \frac{4}{10}$$

$$P(\text{different}) = \frac{28}{110} + \frac{28}{110} = \frac{28}{55}$$

FINAL ANSWER

Missing probabilities $\frac{4}{10}$ and $\frac{6}{10}$; $P(RR) = \frac{6}{55}$; $P(\text{different}) = \frac{28}{55}$.

4WM1/01 SPECIMEN

Question 12

5 marks | Algebraic Fractions

12 (a) Factorise $9x^2 - 4y^2$

.....

(2)

(b) Express $\frac{7}{8} - \frac{x+3}{4x}$ as a single fraction in its simplest form.

.....

(3)

(Total for Question 12 is 5 marks)

WORKED SOLUTION

Question 12 · 4WM1/01 Specimen

1 **Use difference of two squares**

$$9x^2 - 4y^2 = (3x)^2 - (2y)^2$$

$$= (3x - 2y)(3x + 2y)$$

2 **Use a common denominator**

$$\frac{7}{8} - \frac{x+3}{4x} = \frac{7x}{8x} - \frac{2(x+3)}{8x}$$

3 **Simplify the numerator**

$$\frac{7x - 2x - 6}{8x} = \frac{5x - 6}{8x}$$

✓ **FINAL ANSWER**

$(3x - 2y)(3x + 2y)$, and $\frac{5x-6}{8x}$.

Question 13

6 marks | Algebraic Roots & Indices

13 (a) Expand and simplify $(3x-1)(x+2)(3x+1)$

.....

(3)

(b) Simplify fully $\left(\frac{2x^5}{8xy^2}\right)^{-2}$

.....

(3)

(Total for Question 13 is 6 marks)

1 **Multiply the conjugate factors**

$$(3x-1)(3x+1) = 9x^2 - 1$$

2 **Expand the remaining bracket**

$$(9x^2-1)(x+2) = 9x^3 + 18x^2 - x - 2$$

3 **Simplify inside the bracket**

$$\frac{2x^5}{8xy^2} = \frac{x^4}{4y^2}$$

4 **Apply the negative power**

$$\left(\frac{x^4}{4y^2}\right)^{-2} = \left(\frac{4y^2}{x^4}\right)^{2} = \frac{16y^4}{x^8}$$

✓ **FINAL ANSWER**

$9x^3 + 18x^2 - x - 2$, and $\frac{16y^4}{x^8}$.

Question 14

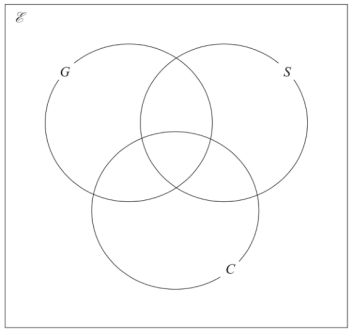
8 marks | Set Notation & Venn Diagrams

14 100 farmers are asked if they have goats (G), sheep (S) or chickens (C) on their farms.

Of these farmers

31 have sheep
53 have chickens
6 have goats, sheep and chickens
11 have sheep and goats
17 have sheep and chickens
18 have goats and chickens
20 do not have any goats, sheep or chickens

(a) Using this information, complete the Venn diagram to show the number of farmers in each appropriate subset.



(3)

(b) Find

(i) $n(G)$

.....

(1)

(ii) $n([G \cup S]')$

.....

(1)

(iii) $n(G' \cap C)$

.....

(1)

One of the farmers who has chickens is chosen at random.

(c) Find the probability that this farmer also has goats.

.....

(2)

(Total for Question 14 is 8 marks)

1 **Place the centre value**

The number with goats, sheep and chickens is 6.

2 **Fill the pair-only regions**

$$G \cap S \text{ only} = 11 - 6 = 5$$

$$S \cap C \text{ only} = 17 - 6 = 11$$

$$G \cap C \text{ only} = 18 - 6 = 12$$

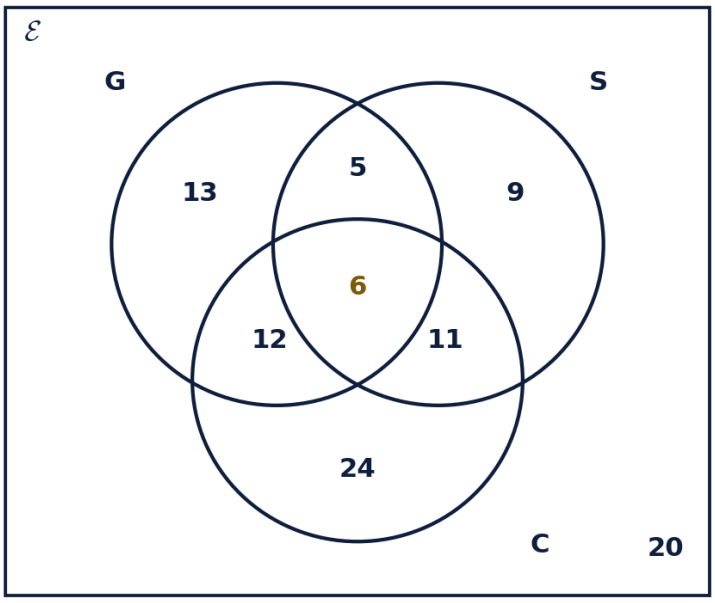
3 **Fill the single-set regions**

$$S \text{ only} = 31 - 5 - 11 - 6 = 9$$

$$C \text{ only} = 53 - 11 - 12 - 6 = 24$$

Since 20 have none, the total inside the circles is 80.

$$G \text{ only} = 80 - (5 + 11 + 12 + 6 + 9 + 24) = 13$$



4 Read the set values

$$n(G) = 13 + 5 + 12 + 6 = 36$$

$$n((G \cup S)') = 24 + 20 = 44$$

$$n(G' \cap C) = 24 + 11 = 35$$

---

5 Find the conditional probability

Out of the 53 farmers with chickens, 18 also have goats.

$$P(G \mid C) = \frac{18}{53}$$

FINAL ANSWER

Venn regions: G only 13, S only 9, C only 24, $G \cap S$ only 5, $S \cap C$ only 11, $G \cap C$ only 12, all three 6, none 20. Also 36, 44, 35, and $\frac{18}{53}$.

Question 15

4 marks | Rounding, Estimation & Bounds

15 Martin and Lucia went on two different car journeys.

For Martin's journey

distance = 80 km correct to the nearest 5 km
time = 2.7 hours correct to 1 decimal place

For Lucia's journey

distance = 33 km correct to 2 significant figures
time = 1 hour correct to the nearest 0.1 hour

Martin says,

"My average speed could have been greater than Lucia's average speed."

By considering bounds, show that Martin is correct.
Show your working clearly.

(Total for Question 15 is 4 marks)

1 Use Martin's greatest possible speed

Martin's greatest possible distance is 82.5 km and his least possible time is 2.65 hours.

$$\frac{82.5}{2.65} = 31.132\ldots$$

2 Use Lucia's least possible speed

Lucia's least possible distance is 32.5 km and her greatest possible time is 1.05 hours.

$$\frac{32.5}{1.05} = 30.952\ldots$$

3 Compare the possible speeds

$$31.132\ldots > 30.952\ldots$$

So Martin's speed could have been greater than Lucia's speed.

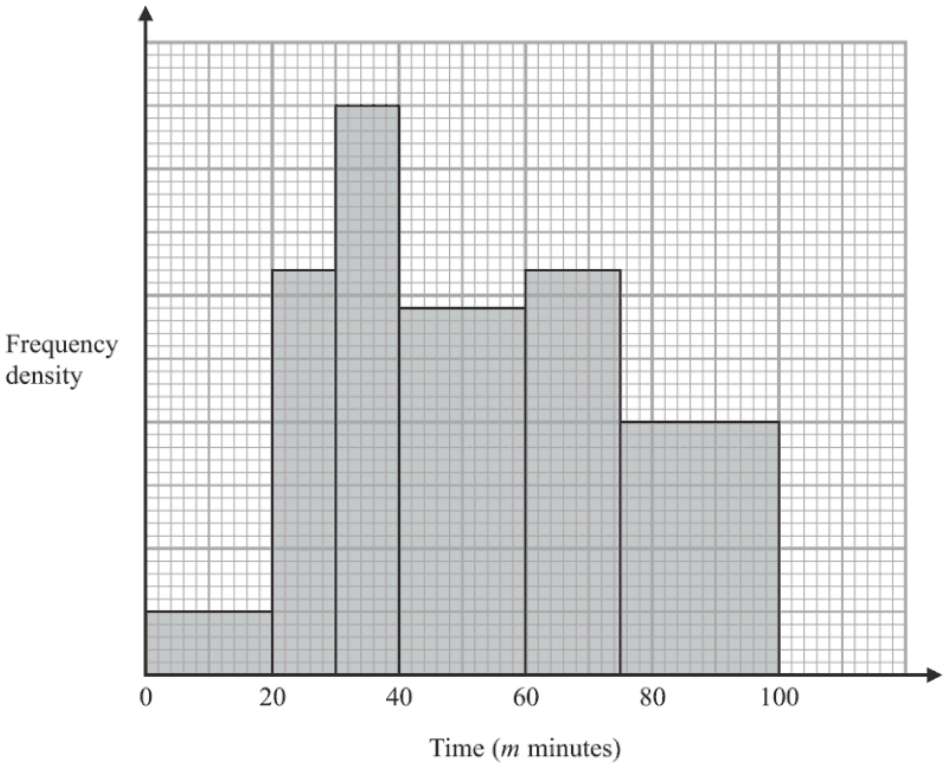
FINAL ANSWER

Martin could have been faster because $31.132\ldots > 30.952\ldots$ km/h.

Question 16

3 marks | Histograms

16 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 $m \leqslant 20$
Work out an estimate for the number of children for whom $50 < m \leqslant 80$

.....

(Total for Question 16 is 3 marks)

1 Set the frequency-density scale

For $0 < m \leq 20$, the frequency is 10, so

$$\text{frequency density} = \frac{10}{20} = 0.5$$

2 Read the needed bar heights

Using the same scale from the histogram:

$$50 < m \leq 60 : \ 10 \times 2.9 = 29$$

$$60 < m \leq 75 : \ 15 \times 3.2 = 48$$

$$75 < m \leq 80 : \ 5 \times 2 = 10$$

3 Add the estimates

$$19 + 36 + 32 = 87$$

FINAL ANSWER

87.

4WM1/01 SPECIMEN

Question 17

4 marks | Surds

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

Show clearly each stage of your working.

.....

(Total for Question 17 is 4 marks)

WORKED SOLUTION

Question 17 · 4WM1/01 Specimen

1 Simplify the surds

$$\sqrt{8}=2\sqrt{2}$$

$$(\sqrt{2}-1)^2=2-2\sqrt{2}+1=3-2\sqrt{2}$$

2 Use the conjugate

$$\frac{3+2\sqrt{2}}{3-2\sqrt{2}}\times\frac{3+2\sqrt{2}}{3+2\sqrt{2}}$$

The denominator is

$$9-(2\sqrt{2})^2=9-8=1$$

3 **Expand the numerator**

$$(3+2\sqrt{2})^2 = 9 + 12\sqrt{2} + 8 = 17 + 12\sqrt{2}$$

4 **Write in the requested form**

$$12\sqrt{2} = \sqrt{144 \times 2} = \sqrt{288}$$

✓ **FINAL ANSWER**

$17 + \sqrt{288}$.

Question 18

4 marks | Circles, Arcs & Sectors

18 The diagram shows two identical circles drawn inside a rectangle.

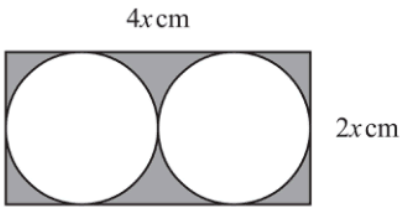


Diagram **NOT** accurately drawn

The length of the rectangle is $4x$ cm and the width of the rectangle is $2x$ cm
Each circle has a radius of x cm

The circles touch each other and each circle touches three sides of the rectangle.

The region inside the rectangle that is outside the circles, shown shaded in the diagram, has a total area of $20\,\text{cm}^2$

Work out the perimeter of the rectangle.
Give your answer correct to 3 significant figures.

..... cm

1 Write the shaded area

Rectangle area:

$$4x \times 2x = 8x^2$$

Area of the two circles:

$$2\pi x^2$$

So

$$8x^2 - 2\pi x^2 = 20$$

2 Solve for x

$$x^2(8 - 2\pi) = 20$$

$$x = \sqrt{\frac{20}{8 - 2\pi}} = 3.413\ldots$$

3 Find the perimeter

$$P = 2(4x + 2x) = 12x$$

$$12(3.413\ldots) = 40.96\ldots$$

4 Round to 3 significant figures

$$40.96\ldots \approx 41.0$$

FINAL ANSWER

41.0 cm.

Question 19

4 marks | 3D Pythagoras & Trigonometry

19 The diagram shows a triangular prism, $ABCDEF$, with a rectangular base $ABCD$

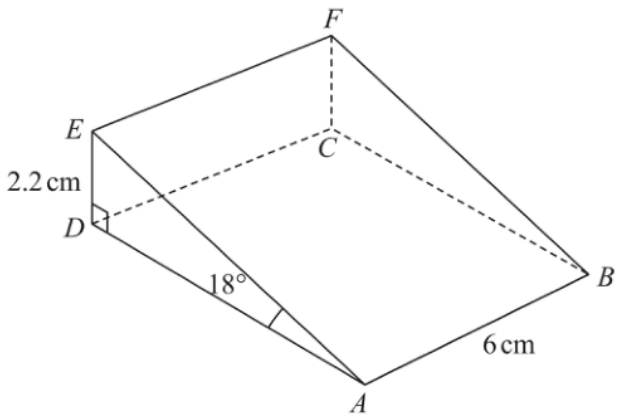


Diagram **NOT** accurately drawn

$AB = 6\,\text{cm}$ $DE = 2.2\,\text{cm}$ angle $DAE = 18°$ angle $ADE = 90°$

Work out the angle that BE makes with the plane $ABCD$
Give your answer correct to one decimal place.

1 Find AD

In triangle ADE,

$$\tan 18^\circ = \frac{DE}{AD}$$

$$AD = \frac{2.2}{\tan 18^\circ} = 6.77\ldots$$

2 Find DB in the base

The base $ABCD$ is a rectangle, so

$$DB = \sqrt{6^2 + 6.77\ldots^2} = 9.04\ldots$$

3 Use the projection triangle

The projection of BE on the plane is BD. Let the required angle be θ.

$$\tan\theta = \frac{DE}{DB} = \frac{2.2}{9.04\ldots}$$

4 Calculate the angle

$$\theta = 13.7^\circ$$

FINAL ANSWER

13.7°.

4WM1/01 SPECIMEN

Question 20

4 marks | Completing the Square

20 Find the values of a, b and c so that

$$7 + 12x - 2x^2$$

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

$a =$ .....

$b =$ .....

$c =$ .....

(Total for Question 20 is 4 marks)

1 **Factor out -2 from the quadratic terms**

$$7 + 12x - 2x^2 = -2(x^2 - 6x) + 7$$

2 **Complete the square**

$$x^2 - 6x = (x - 3)^2 - 9$$

3 **Simplify the expression**

$$-2((x - 3)^2 - 9) + 7 = -2(x - 3)^2 + 18 + 7$$

$$= 25 - 2(x - 3)^2$$

4 **Read the values**

$$a = 25, \qquad b = 2, \qquad c = 3$$

✓ **FINAL ANSWER**

$a = 25,\ b = 2,\ c = 3.$

4WM1/01 SPECIMEN

Question 21

3 marks | Algebraic Fractions

21 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.

Show clear algebraic working.

1 Factorise the denominator

$$x^2 - 36 = (x - 6)(x + 6)$$

2 Simplify the bracket

$$\frac{20}{(x-6)(x+6)} - \frac{2}{x-6} = \frac{20 - 2(x+6)}{(x-6)(x+6)}$$

$$= \frac{8 - 2x}{(x-6)(x+6)} = \frac{-2(x-4)}{(x-6)(x+6)}$$

3 Cancel the common factor

Since $4 - x = -(x - 4)$,

$$\frac{-2(x-4)}{(x-6)(x+6)} \times \frac{1}{4-x} = \frac{2}{(x-6)(x+6)}$$

FINAL ANSWER

$\frac{2}{x^2-36}$.

Question 22

3 marks | Algebraic Roots & Indices

22 $\dfrac{18 \times (\sqrt{27})^{}}{6 \times 9^{2n+8}} = 3^x$

Express x in terms of n

Show your working clearly and simplify your expression.

$x =$ .....

1 Write everything as powers of 3

$$\sqrt{27} = 3^{3/2}, \qquad 9 = 3^2, \qquad \frac{18}{6} = 3$$

2 Simplify the powers

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

$$= 3^1 \times \frac{3^{6n+9}}{3^{4n+16}}$$

3 Subtract the indices

$$3^{1+6n+9-(4n+16)} = 3^{2n-6}$$

So

$$x = 2n - 6$$

FINAL ANSWER

$x = 2n - 6$.

Question 23

6 marks | Linear Graphs

23 $ABCD$ is a kite.

$AB = AD$ and $CB = CD$

The point B has coordinates $(k, 1)$ where k is a negative constant.
The point D has coordinates $(8, 7)$

The straight line **L** passes through the points B and D and has a gradient of $\frac{3}{5}$

Find an equation of AC
Give your answer in the form $px + qy = r$ where p, q and r are integers.
Show your working clearly.

.....

(Total for Question 23 is 6 marks)

1 Find k from the gradient

The gradient of BD is

$$\frac{7-1}{8-k}=\frac{3}{5}$$

$$\frac{6}{8-k}=\frac{3}{5}$$

$$30=24-3k$$

$$k=-2$$

2 Find the midpoint of BD

So $B=(-2,1)$ and $D=(8,7)$.

$$\text{midpoint of } BD=\left(\frac{-2+8}{2},\frac{1+7}{2}\right)=(3,4)$$

3 Use the perpendicular gradient

In this kite, AC is the perpendicular bisector of BD.

The gradient of BD is $\frac{3}{5}$, so the gradient of AC is

$$-\frac{5}{3}$$

4 Form the equation

Using point $(3,4)$:

$$y-4=-\frac{5}{3}(x-3)$$

$$3y-12=-5x+15$$

$$5x+3y=27$$

FINAL ANSWER

$5x+3y=27$.