ELITE

IGCSE Mathematics A • Pearson Edexcel

12_May-Nov_2020 • Unit 2

1H + 2H source-order past paper

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L-to-M | CONVERTED MODULAR EDITION

Selected from Linear Higher papers; not an original Modular examination paper.

Contents

1H Q04 • Statistics Toolkit • 4 marks

1H Q05 • Powers, Roots & Standard Form • 4 marks

1H Q08 • Angles in Polygons & Parallel Lines • 4 marks

1H Q09 • Percentages • 3 marks

1H Q10 • Prime Factors, HCF & LCM • 3 marks

1H Q12 • Simultaneous Equations • 4 marks

1H Q13 • Compound Interest & Depreciation • 3 marks

1H Q14 • Direct & Inverse Proportion • 3 marks

1H Q16 • Circle Theorems • 4 marks

1H Q20 • Area & Volume of Similar Shapes • 3 marks

1H Q23 • Differentiation • 4 marks

1H Q24 • Sequences • 4 marks

1H Q25 • Transformations of Graphs • 3 marks

2H Q01 • Solving Inequalities • 6 marks

2H Q02 • Statistics Toolkit • 5 marks

2H Q04 • Ratio Problem Solving • 4 marks

2H Q05 • Compound Interest & Depreciation • 6 marks

2H Q09 • Volume & Surface Area • 5 marks

2H Q10 • Cumulative Frequency Diagrams • 7 marks

2H Q11 • Solving Inequalities • 8 marks

2H Q15 • Rearranging Formulas • 4 marks

2H Q16 • Simultaneous Equations • 5 marks

2H Q17 • Solving Inequalities • 5 marks

2H Q19 • Vectors • 3 marks

2H Q21 • Functions • 7 marks

4 Here is a list of six numbers written in order of size.

$$4 \quad 7 \quad x \quad 10 \quad y \quad y$$

The numbers have

a median of 9
a mean of 11

Find the value of x and the value of y.

$x =$ .....

$y =$ .....

(Total for Question 4 is 4 marks)

ANSWER / WORKED SOLUTION

1H • Family: Calculate and reverse discrete averages • Variant: Calculate the mean from a list or discrete frequency table • CHECKED LEGACY SOLUTION

Topic check: Statistics Toolkit. The tag is correct.

Solution

The median is 9:

$(x+10)/(2)=9$

$x=8$

The mean is 11, so the total is

$6 \times 11=66$

$4+7+8+10+y+y=66$

$29+2y=66$

$2y=37$

$y=18.5$

Answers: $x=8,\ y=18.5$.

5 (a) Write 5.7×10^{-3} as an ordinary number.

.....

(1)

(b) Write 800 000 in standard form.

.....

(1)

(c) Work out $\dfrac{3 \times 10^5 - 2.7 \times 10^4}{6 \times 10^{-2}}$

.....

(2)

(Total for Question 5 is 4 marks)

ANSWER / WORKED SOLUTION

1H • Family: Convert and compare standard form • Variant: Ordinary number to standard form • CHECKED LEGACY SOLUTION

Topic check: Powers, roots and standard form. The tag is correct.

Method

5.7× 10^(-3)=0.0057

800000=8× 10^5

For part (c), first simplify the numerator:

3× 10^5-2.7× 10^4=300000-27000=273000

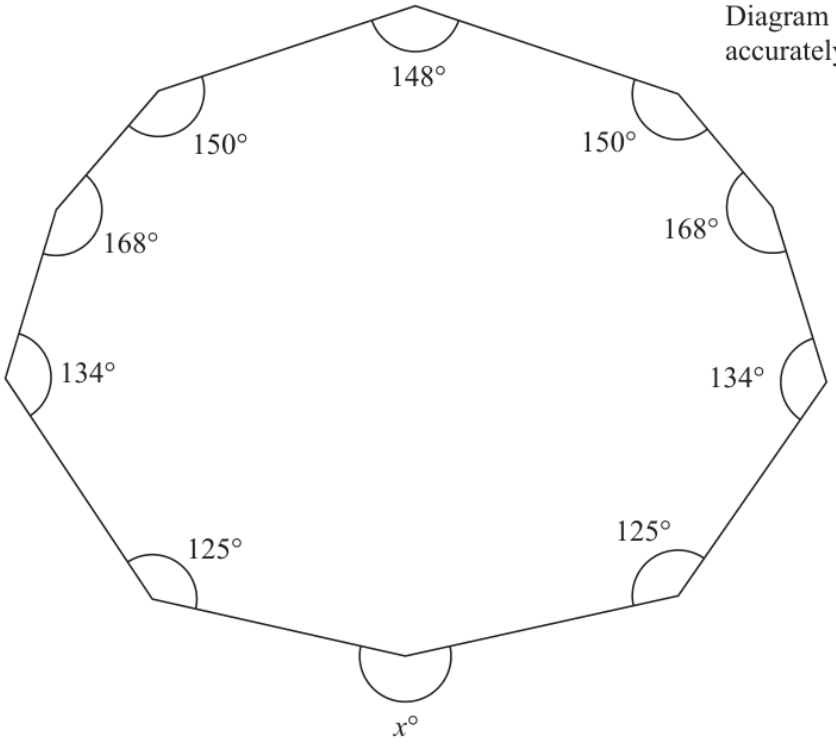
Then

frac{273000}{6× 10^(-2)}=(273000)/(0.06)=4550000

4550000=4.55× 10^6

Answer: (a) 0.0057, (b) 8× 10^5, (c) 4.55× 10^6

8 Here is a 10-sided polygon.



Work out the value of x.

$x =$ .....

(Total for Question 8 is 4 marks)

ANSWER / WORKED SOLUTION

1H • Family: Use regular and general polygon angles • Variant: Find the interior-angle sum of a polygon •
CHECKED LEGACY SOLUTION

Topic check: Angles in Polygons & Parallel Lines. The tag is correct.

Solution

The sum of the interior angles of a 10-sided polygon is

$(10-2)\times 180=1440^\circ$

The sum of the 9 given interior angles is

$150+168+134+125+125+134+168+150+148=1302^\circ$

So the missing interior angle is

$1440^\circ-1302^\circ=138^\circ$

The angle x is the reflex angle outside the polygon at this vertex:

$x=360^\circ-138^\circ=222^\circ$

Answer: 222°.

9 In a sale, normal prices are reduced by 20%

A bag costs 1080 rupees in the sale.

Work out the normal price of the bag.

..... rupees

(Total for Question 9 is 3 marks)

ANSWER / WORKED SOLUTION

1H • Family: Apply a percentage operator • Variant: Combine percentage with fraction or ratio groups • CHECKED LEGACY SOLUTION

Topic check: Percentages. The tag is correct.

Method

A reduction of 20\% means the sale price is 80\% of the normal price.

0.80× normal price=1080

normal price=(1080)/(0.80)=1350

Answer: 1350 rupees

10 $A = 2 \times 3^{43}$
$B = 16 \times 3^{37}$

(a) Find the highest common factor (HCF) of A and B.

.....

(1)

(b) Express the number $A \times B$ as a product of powers of its prime factors.
Give your answer in its simplest form.

.....

(2)

(Total for Question 10 is 3 marks)

ANSWER / WORKED SOLUTION

1H • Family: Build or manipulate prime-power form • Variant: Combine given prime-power products • CHECKED LEGACY SOLUTION

Topic check: Prime factors, HCF and LCM. The tag is correct.

Method

$A=2\times 3^{43}$

$B=16\times 3^{37}=2^4\times 3^{37}$

For the HCF, take the smaller powers:

$HCF=2\times 3^{37}$

For $A\times B$,

$A\times B=(2\times 3^{43})(2^4\times 3^{37})$

$A\times B=2^5\times 3^{80}$

Answer: (a) 2×3^{37}, (b) $2^5\times 3^{80}$

12 Solve the simultaneous equations

$$7x - 2y = 34$$
$$3x + 5y = -3$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 12 is 4 marks)

ANSWER / WORKED SOLUTION

1H • Family: Interpret a system graphically • Variant: Draw the missing line for an intersection •
CHECKED LEGACY SOLUTION

Topic check: Simultaneous equations. The tag is correct.

Solution

$7x-2y=34$

$3x+5y=-3$

Multiply the first equation by 5:

$35x-10y=170$

Multiply the second equation by 2:

$6x+10y=-6$

Add:

$41x=164$

$x=4$

Substitute into $3x+5y=-3$:

$12+5y=-3$

$y=-3$

Answer: $x=4$, $y=-3$.

13 Jan invests \$8000 in a savings account.
The account pays compound interest at a rate of x% per year.

At the end of 6 years, there is a total of \$8877.62 in the account.

Work out the value of x.
Give your answer correct to 2 decimal places.

$x =$ .....

(Total for Question 13 is 3 marks)

ANSWER / WORKED SOLUTION

1H • Family: Accumulate compound growth • Variant: Known annual compound-interest rate • CHECKED LEGACY SOLUTION

Topic check: Compound Interest and Depreciation. The tag is correct.

Method

Let the compound interest rate be x\%.

$8000(1+(x)/(100))^6=8877.62$

$1+(x)/(100)=sqrt[6]{(8877.62)/(8000)}=1.017500ldots$

$x=1.7500ldots$

Correct to 2 decimal places,

$x=1.75$

Answer: $x=1.75$

14 F is inversely proportional to the square of v.

Given that $F = 6.5$ when $v = 4$

find a formula for F in terms of v.

.....

(Total for Question 14 is 3 marks)

ANSWER / WORKED SOLUTION

1H • Family: Build an inverse-variation model • Variant: Inverse-square or inverse-power variation • CHECKED LEGACY SOLUTION

Topic check: Direct and Inverse Proportion. The tag is correct.

Method

F is inversely proportional to v^2, so

F=(k)/(v^2)

Use F=6.5 when v=4:

6.5=(k)/(4^2)

k=6.5× 16=104

Therefore

F=(104)/(v^2)

Answer: F=(104)/(v^2).

16

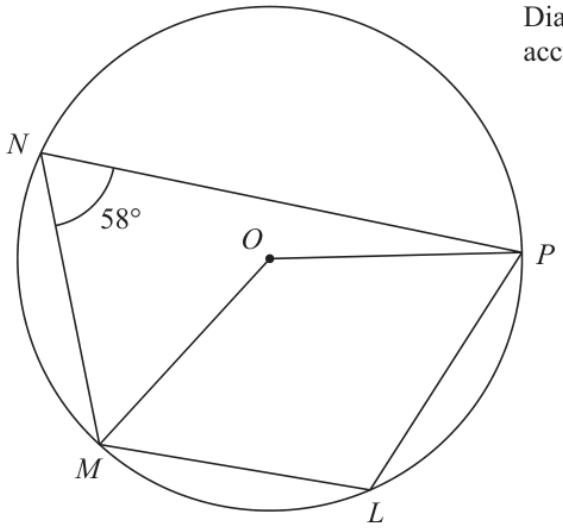


Diagram **NOT** accurately drawn

L, M, N and P are points on a circle, centre O

Angle $MNP = 58°$

(a) (i) Find the size of angle MLP

.....°

(ii) Give a reason for your answer.

.....

.....

(2)

(b) Find the size of the reflex angle MOP

.....°

(2)

(Total for Question 16 is 4 marks)

ANSWER / WORKED SOLUTION

1H • Family: Write justified circle-angle chains • Variant: Complete a multi-theorem circle-angle chain •
CHECKED LEGACY SOLUTION

Topic check: Circle Theorems. The tag is correct.

Solution

(a) Opposite angles in cyclic quadrilateral MNPL add to 180^circ:

□ MLP=180^circ-58^circ=122^circ

(b) The angle at the centre is twice the angle at the circumference standing on the same arc MP:

□ MOP=2× 58^circ=116^circ

The reflex angle is

360^circ-116^circ=244^circ

Answer: □ MLP=122^circ, and reflex □ MOP=244^circ.

20 **R** and **S** are two similar solid shapes.

Shape **R** has surface area 108 cm^2 and volume 135 cm^3
Shape **S** has surface area 300 cm^2

Work out the volume of shape **S**.

..... cm^3

(Total for Question 20 is 3 marks)

ANSWER / WORKED SOLUTION

1H • Family: Use area scale factors of similar figures • Variant: Solve an area difference or sum for similar figures • CHECKED LEGACY SOLUTION

Topic check: Correct.

Method

Shape R has surface area 108 cm^2 and volume 135 cm^3.

Shape S has surface area 300 cm^2.

Surface area ratio S:R:

300:108=25:9

So the linear ratio S:R is

5:3

Therefore the volume ratio S:R is

5^3:3^3=125:27

Volume of S:

135× (125)/(27)=625

Answer: boxed{625 cm^3}

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)

ANSWER / WORKED SOLUTION

1H • Family: Use the derivative as gradient or rate • Variant: Points where gradient equals a value •
CHECKED LEGACY SOLUTION

Topic check: Corrected from Functions to Differentiation.

Method

$y=px^3-mx$

Differentiate:

$\frac{dy}{dx}=3px^2-m$

The gradient is negative when

$3px^2-m<0$

$3px^2<m$

$x^2<\frac{m}{3p}$

So

$-\sqrt{\frac{m}{3p}}<x<\sqrt{\frac{m}{3p}}$

Answer: $-\sqrt{\dfrac{m}{3p}}<x<\sqrt{\dfrac{m}{3p}}$

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)

ANSWER / WORKED SOLUTION

1H • Family: Use an arithmetic nth term • Variant: Arithmetic nth term from listed terms • CHECKED LEGACY SOLUTION

Topic check: Correct.

Method

The arithmetic sequence is

$8,\ 15,\ 22,\ 29,\ 36,\ldots$

So

$a=8,\quad d=7$

The nth term is

$u_n=8+7(n-1)=7n+1$

$u_{(50)}=7(50)+1=351$

$u_{(100)}=7(100)+1=701$

There are

$100-50+1=51$

terms from the 50th to the 100th inclusive.

$\text{sum}=(51)/(2)(351+701)$

$=26826$

Answer: 26826

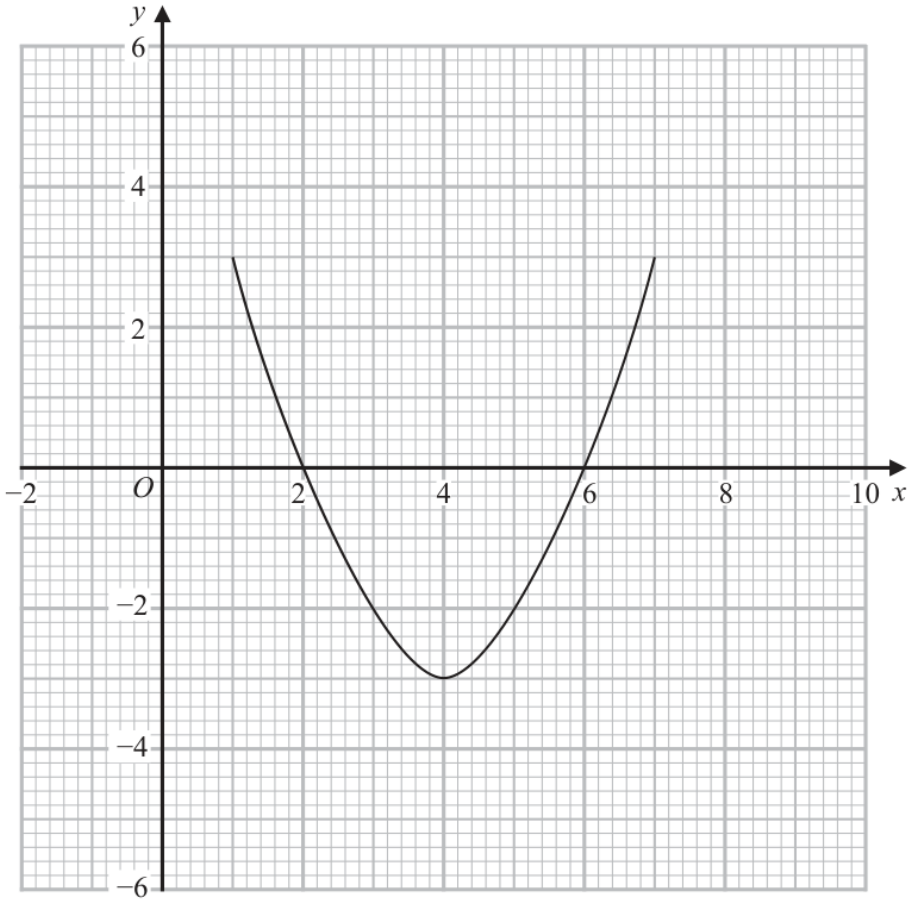
25 The curve with equation $y = g(x)$ is transformed to the curve with equation $y = -g(x)$ by the single transformation **T**.

(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)

ANSWER / WORKED SOLUTION

1H • Family: Write the transformed equation • Variant: Transform an explicit polynomial and simplify •
CHECKED LEGACY SOLUTION

Topic check: Correct.

Method

For part (a),

$y=g(x)\text{to } y=-g(x)$

The x-coordinates stay the same and the y-coordinates change sign.

So the transformation is a reflection in the x-axis.

For part (b),

$y=2f(x-1)$

First, x-1 moves the graph 1 unit right. Then the factor 2 stretches the graph vertically by scale factor 2.

Use points from the original graph:

$(1,3)\text{to}(2,6)$

$(2,0)\text{to}(3,0)$

$(4,-3)\text{to}(5,-6)$

$(6,0)\text{to}(7,0)$

$(7,3)\text{to}(8,6)$

Draw the transformed parabola through these points.

Answer: reflection in the x-axis; transformed graph through (2,6), (3,0), (5,-6), (7,0), (8,6)

1 (a) Simplify $g^6 \times g^4$

.....

(1)

(b) Simplify $k^{10} \div k^3$

.....

(1)

(c) Simplify $(3cd^4)^2$

.....

(2)

(d) Solve the inequality $4x + 7 > 2$

.....

(2)

(Total for Question 1 is 6 marks)

Q		Working	Answer	Mark	Notes	
1	a		g^{10}	1	B1	
	b		k^7	1	B1	
	c		$9c^2d^8$	2	B2	B1 for 2 out of 3 terms correct in a product
	d	$4x > 2 - 7$ oe			M1	accept as an equation or with wrong inequality sign.
			$x > -1.25$	2	A1	oe allow $(-1.25, (+)\infty)$ Note: award M1A0 for an answer on the answer line of -1.25 with no sign or the incorrect sign eg $x = -1.25$, $x < -1.25$
						Total 6 marks

2 The table shows information about the lengths of time, in minutes, 120 customers spent in a supermarket.

Length of time (L minutes)	Frequency
$20 < L \leqslant 30$	6
$30 < L \leqslant 40$	26
$40 < L \leqslant 50$	31
$50 < L \leqslant 60$	40
$60 < L \leqslant 70$	17

(a) Write down the modal class.

.....

(1)

(b) Work out an estimate for the mean length of time spent by the 120 customers in the supermarket.

..... minutes

(4)

(Total for Question 2 is 5 marks)

2	a		$50 < L \leq 60$	1	B1	oe eg 50 - 60
	b	$25 \times 6 + 35 \times 26 + 45 \times 31 + 55 \times 40 + 65 \times 17$ $(150 + 910 + 1395 + 2200 + 1105)(= 5760)$			M2	For correct products using midpoints (allow one error) with intention to add. M1 for products using frequency and a consistent value within the range (allow one error) with intention to add or correct products using midpoints (allow one error) without addition
		"5760" ÷ "120"			M1	dep on M1
			48	4	A1	
						Total 5 marks

4 Andreas, Isla and Paulo share some money in the ratios 3 : 2 : 5

The **total** amount of money that Isla and Paulo receive is £76 more than the amount of money that Andreas receives.

Andreas buys a video game for £48.50 with some of his share of the money.

Work out how much money Andreas has left from his share of the money when he has bought the video game.

£.....

(Total for Question 4 is 4 marks)

4	eg 76 ÷ (5 + 2 – 3) oe (= 19) or $5x + 2x - 3x = 76$ **and** $x = 76 \div (5 + 2 - 3)$ (=19) oe			M1 For a correct method to find the value of 1 share
	3 × "19" (= 57)			M1
	"57" – 48.5(0)			M1
		8.5(0)	4	A1
				Total 4 marks

5 Himari's annual salary is 3 130 000 Japanese Yen (JPY).
She gets a salary increase of 4%

(a) Work out Himari's salary after this increase.

.....JPY
(3)

Kaito bought a car.
The value of the car when Kaito bought it was 750 000 JPY.
At the end of each year, the value of his car had depreciated by 15%

(b) Work out the value of Kaito's car at the end of 3 years.
Give your answer correct to the nearest JPY.

..... JPY
(3)

(Total for Question 5 is 6 marks)

5	a	1.04 × 3 130 000 oe				M2	complete method to increase salary by 4% M1 for 0.04 × 3 130 000 oe (= 125 200)	
				3 255 200	3	A1		
	b	for 0.15 × 750 000 oe (=112 500) **or** 0.85 × 750 000 oe (=637 500)	**OR**			M1	For method to find depreciation for 1 year or value after 1 year	**or** M2 for 750 000 × 0.85^3 (= 460 593.75) **or** 750 000 × 0.85^4 (= 391 504.69) (M1 for 750 000 × 0.85^2 (= 541 875)
		0.85 × "637 500" oe (= 541 875) 0.85 × "541 875" oe(= 460 593.75)	750 000 × 0.85^3			M1	for completing method	
				460 594	3	A1	accept 460 593 – 460 594	
							SC: if no other marks gained award M1 for 0.55 × 750 000 oe **(=** 412 500) **or** 0.45 × 750 000 oe **(=** 337 500) accept (1 – 0.15) as equivalent to 0.85 throughout	
								Total 6 marks

9 The diagram shows a solid cylinder with radius 3 m.

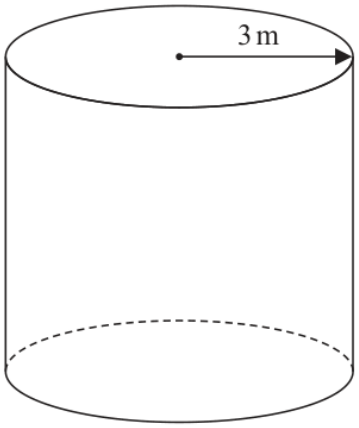


Diagram **NOT** accurately drawn

The volume of the cylinder is 72π m^3

Calculate the **total** surface area of the cylinder.
Give your answer correct to 3 significant figures.

..... m^2

(Total for Question 9 is 5 marks)

9	$\pi \times 3^2 \times h = 72\pi$ oe			M1	Allow use of 3.14... or $\frac{22}{7}$ for π and use of 226... for 72π
	$h = 72\pi \div (\pi \times 3^2)$ oe **or** $h = 8$			M1	method to isolate h (may be seen in several stages)
	$2 \times \pi \times 3^2$ (= 18π or 56.54...) **or** $2 \times \pi \times 3 \times$ "8" oe (= 48π or 150 - 151)			M1	method to find the area of the two circles **or** curved surface area – use of their h, dep on 1st M1 (NB may get this mark for total area of 2 circles with no previous marks awarded)
	$2 \times \pi \times 3^2 + 2 \times \pi \times 3 \times$ "8" oe (= 66π)			M1	method to find total surface area ft their h dep on 1st M1, including intention to add, to find the total surface area
		207	5	A1	accept 207-208
					Total 5 marks

10 The table shows information about the number of minutes each of 120 buses was late last Monday.

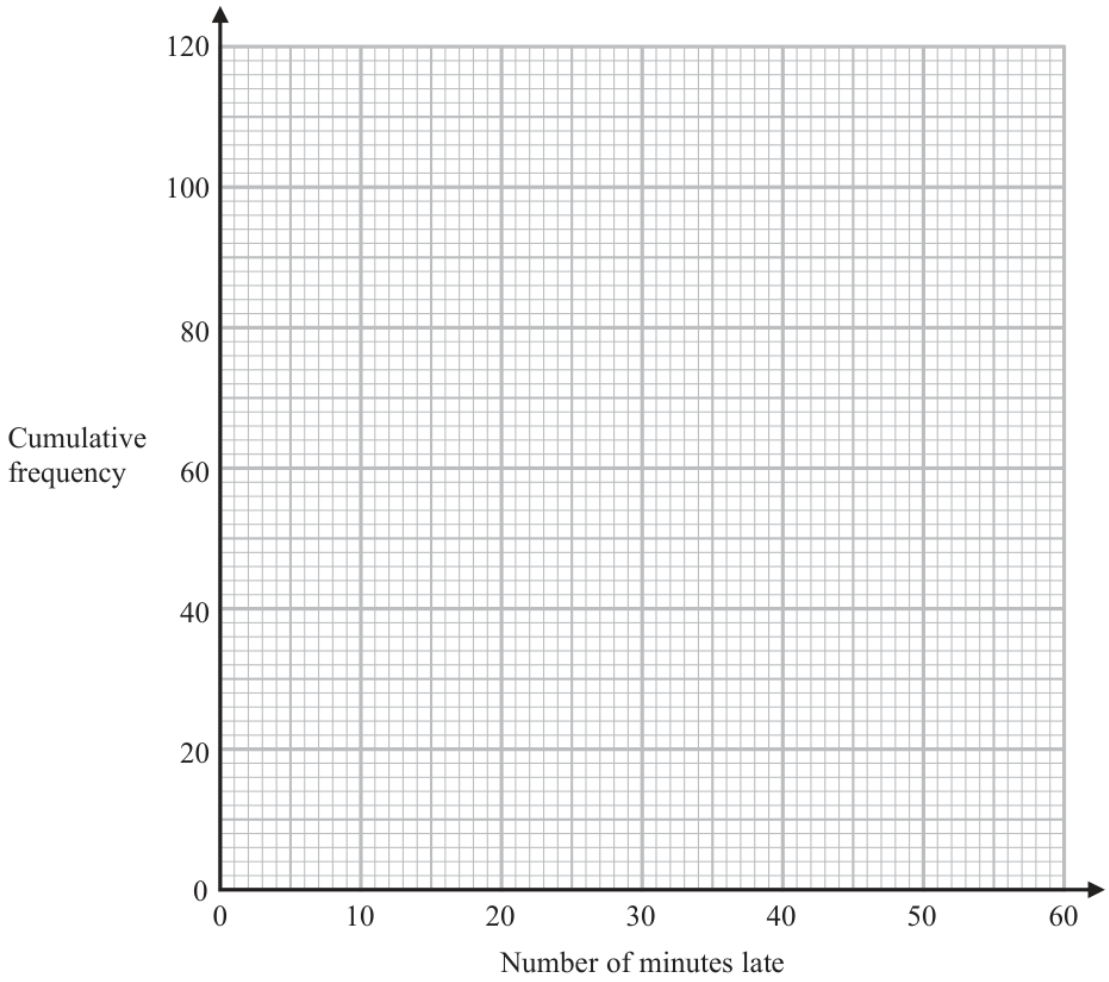
Number of minutes late (L)	Frequency
$0 < L \leqslant 10$	10
$10 < L \leqslant 20$	16
$20 < L \leqslant 30$	44
$30 < L \leqslant 40$	29
$40 < L \leqslant 50$	15
$50 < L \leqslant 60$	6

(a) Complete the cumulative frequency table below.

Number of minutes late (L)	Cumulative frequency
$0 < L \leqslant 10$	
$0 < L \leqslant 20$	
$0 < L \leqslant 30$	
$0 < L \leqslant 40$	
$0 < L \leqslant 50$	
$0 < L \leqslant 60$	

(1)

(b) On the grid, draw a cumulative frequency graph for your table.



(2)

(c) Use your graph to find an estimate for the interquartile range.

..... minutes

(2)

(d) Use your graph to find an estimate for the number of buses that were more than 48 minutes late last Monday.

.....

(2)

(Total for Question 10 is 7 marks)

10	a		10, 26, 70, 99, 114, 120	1	B1	
	b		correct cumulative frequency graph	2	B2	fully correct cf graph – points at ends of intervals and joined with curve or line segments If not B2 then B1 for 5 or 6 (ft from a table with only one arithmetic error) of their points at ends of intervals and joined with curve or line segments **OR** for 5 or 6 points plotted correctly at ends of intervals not joined **OR** for 5 or 6 of their points from table plotted consistently within each interval (not at upper ends of intervals) at their correct heights and joined with smooth curve or line segments
	c				M1	For use of 30 and 90, or 30.25 and 90.75 (eg reading of 21 and 37 stated or indicated by marks on horizontal axis that correspond to 30 (or 30.25) and 90 (or 90.75) on the vertical axis or correct readings ft their cf graph provided method to show readings is shown)
			16	2	A1	accept 14 – 18, ft from their cf graph (ft provided method to show readings is shown)
	d				M1	For use of cf from number of minutes late being 48 (eg an indication by a mark on the vertical axis corresponding to 48 mins late or a correct reading ft their cf graph)
			9	2	A1	accept 7 – 10, ft from their cf graph
						Total 7 marks

11 (a) Simplify fully $(8e^{15})^{\frac{2}{3}}$

.....

(2)

(b) Express $\left(\frac{y}{2}\right)^{-4}$ in the form ay^n where a and n are integers.

.....

(2)

(c) Solve $\frac{4x-2}{3} - \frac{5-3x}{4} = 6$

Show clear algebraic working.

$x =$ .....

(4)

(Total for Question 11 is 8 marks)

11	a		$4e^{10}$	2	B2	(B1 for $4e^{k}$ **or** ke^{10})
	b	A correct first step eg $\frac{y^{-4}}{2^{-4}}$ **or** $\left(\frac{y^4}{16}\right)^{-1}$ **or** $\frac{y^{-4}}{0.0625}$ **or** $\left(\frac{2}{y}\right)^4$ **or** $\frac{16}{y^4}$ **or** $\left(\frac{1}{y/2}\right)^4$ **or** $\frac{1}{\left(y/2\right)^4}$			M1	or for $16y^{p}$ where $p \neq -4$
			$16y^{-4}$	2	A1	
	c	eg $12\times\frac{4x-2}{3}-12\times\frac{5-3x}{4}=12\times6$ **or** eg $4(4x-2)-3(5-3x)=12\times6$ **or** eg $\frac{4(4x-2)}{12}-\frac{3(5-3x)}{12}(=6)$ **or** eg $\frac{4(4x-2)-3(5-3x)}{12}(=6)$ oe			M1	for clear intention to multiply **all** terms by 12 or a multiple of 12 **or** to express LHS as two fractions over 12 or a multiple of 12 or as a single fraction with a denominator of 12 or a multiple of 12 (if expanded numerator, allow one sign error)
		eg $16x-8-15+9x=6\times12$			M1	expanding brackets and multiplying both sides by denominator with no more than one sign error
		eg $16x+9x=72+8+15$			M1	for correct rearrangement of a correct equation with terms in x isolated
			3.8	4	A1	oe, award full marks for a correct answer if at least M1 scored
						Total 8 marks

15 Make x the subject of $y = \dfrac{5 - 2x}{x + 3}$

(Total for Question 15 is 4 marks)

15	$xy + 3y = 5 - 2x$ oe			M1	multiplying both sides by $(x + 3)$ and expanding the brackets correctly
	e.g. $xy + 2x = 5 - 3y$			M1	ft dep on 2 terms on left and $(5 - 2x)$ on right, for collecting all x terms on one side and non-x terms on the other side
	eg $x(y + 2) = 5 - 3y$			M1	ft, dep on 2 terms in x, for factorising for x
		$x = \frac{5-3y}{2+y}$	4	A1	oe allow $\frac{5-3y}{2+y}$ as answer so long as previously seen $x = \frac{5-3y}{2+y}$
					Total 4 marks

16 Solve the simultaneous equations

$$3xy - y^2 = 8$$
$$x - 2y = 1$$

Show clear algebraic working.

(Total for Question 16 is 5 marks)

16	$3y(2y+1)-y^2=8$ **or** $x=\frac{8+y^2}{3y} \rightarrow \frac{8+y^2}{3y}-2y=1$ **or** $_\ 3xy-y^2=8$ $3xy-3y\times 2y=3y\times 1$ oe	$3x\left(\frac{x-1}{2}\right)-\left(\frac{x-1}{2}\right)^2=8$ oe			M1	correct first step eg substitution by eg $x=1+2y$ or $y=\frac{x-1}{2}$ to get an equation in a single variable **or** writing 2nd equation with x the subject and substituting into 1st **or** multiplying 2nd equation by $3y$ and subtracting from 1st oe
	eg $5y^2+3y-8\ (=0)$	eg $5x^2-4x-33\ (=0)$			A1	for a correct simplified quadratic
	$(5y+8)(y-1)\ (=0)$ or $\frac{-3\pm\sqrt{3^2-4\times 5\times(-8)}}{2\times 5}$	$(5x+11)(x-3)\ (=0)$ or $\frac{4\pm\sqrt{(-4)^2-4\times 5\times(-33)}}{2\times 5}$			M1ft	dep on M1 for solving their 3 term quadratic equation using any correct method (allow one sign error and some simplification – allow as far as $\frac{-3\pm\sqrt{9+160}}{10}$) or if factorising, allow brackets which expanded give 2 out of 3 terms correct)
	$y=-\frac{8}{5}$ and $y=1$ (both)	$x=-\frac{11}{5}$ and $x=3$ (both)			A1	dep on first M1
			$x=-\frac{11}{5}, y=-\frac{8}{5}$ $x=3, y=1$	5	A1	oe dep on first M1 Must be paired correctly
						Total 5 marks

17 The diagram shows a rectangle.

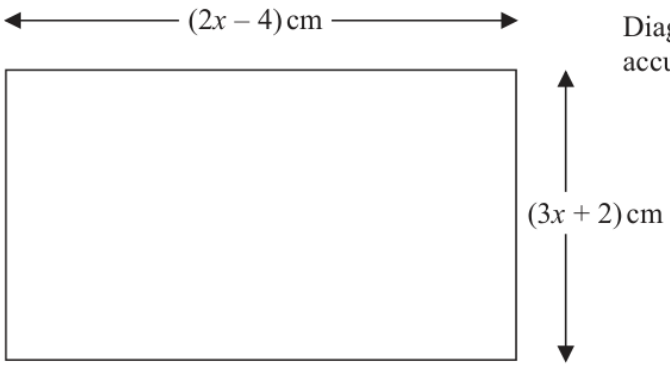


Diagram **NOT** accurately drawn

The area of the rectangle is A cm^2

Given that $A < 3x + 27$
find the range of possible values for x.

.....

(Total for Question 17 is 5 marks)

17	$(3x + 2)(2x - 4) < 3x + 27$oe eg $6x^2 - 8x - 8 < 3x + 27$			M1	condone incorrect symbol
	eg $6x^2 - 11x - 35 < 0$			M1	expanding and rearranging to get a correct 3 term quadratic, condone incorrect symbol
	$(2x - 7)(3x + 5)$ $(= 0)$ or $\frac{11 \pm \sqrt{(-11)^2 - 4 \times 6 \times (-35)}}{2 \times 6}$			M1	first step to find the critical values dep on M1 for solving their 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as the equivalent of $\frac{11 \pm \sqrt{121 + 840}}{12}$) or if factorising, allow brackets which expanded give 2 out of 3 terms correct)
	$-\frac{5}{3}, \frac{7}{2}$			A1	oe the positive critical value only or both critical values (if both they must be correct)
		$2 < x < \frac{7}{2}$	5	A1	accept $2 \leq x < \frac{7}{2}$ may be seen as two separate inequalities $x > 2$ $(x \leq 2)$ **and** $x < \frac{7}{2}$
					Total 5 marks

19 OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$ $\overrightarrow{OB} = \mathbf{b}$

The point C lies on OA such that $OC : CA = 1 : 2$
The point D lies on OB such that $OD : DB = 1 : 2$

Using a vector method, prove that $ABDC$ is a trapezium.

(Total for Question 19 is 3 marks)

19	$\overrightarrow{AB} = -\mathbf{a} + \mathbf{b}$ or $\overrightarrow{BA} = \mathbf{a} - \mathbf{b}$			M1	Correct diagram (condone missing vector labels or arrows – with C on line segment OA and D on line segment OB) **OR** for finding $\overrightarrow{AB}$ or $\overrightarrow{BA}$ - may be seen as part of later working
	$\overrightarrow{CD} = \frac{1}{3}(-\mathbf{a} + \mathbf{b})$ or $\overrightarrow{DC} = \frac{1}{3}(\mathbf{a} - \mathbf{b})$oe			M1	Method to find $\overrightarrow{CD}$ or $\overrightarrow{DC}$
		Correct vectors and conclusion including parallel and trapezium	3	A1	eg $\overrightarrow{AB}$ (AB) and $\overrightarrow{CD}$ (CD) are parallel therefore $ABDC$ is a trapezium
					Total 3 marks

21 The function f is such that $f(x) = 5 + 6x - x^2$ for $x \leqslant 3$

(a) Express $5 + 6x - x^2$ in the form $p - (x - q)^2$ where p and q are constants.

.....

(2)

(b) Using your answer to part (a), find the range of values of x for which $f^{-1}(x)$ is positive.

.....

(5)

(Total for Question 21 is 7 marks)

21	a	$5-(x\pm q)^2+9$ oe **or** $p-(x-3)^2$ oe **or** $p-q^2+2qx-x^2$ and one of $2q=6$ **or** $p-q^2=5$			M1	may be seen in working eg $-[(x-3)^2-9-5]$ **or** expanding $p-(x-q)^2$ correctly and equating one of the coefficient of x or the constant term
			$14-(x-3)^2$	2	A1	fully correct SCB1 for $(x-3)^2-14$
	b	e.g. $(x-3)^2=14-y$ [or $(y-3)^2=14-x$]			M1	correct steps to isolate their bracket ft from (a) dep on expression in form $\pm p\pm(x-q)^2$
		$x=3\pm\sqrt{14-y}$ [or $y=3\pm\sqrt{14-x}$]			M1	complete method to find y in terms of x or x in terms of y. Condone + for ± ft from (a) dep on expression in form $\pm p\pm(x-q)^2$
		$(f^{-1}(x)=)\ 3-\sqrt{14-x}$			M1	for the correct inverse
					M1	method to solve $0<3-\sqrt{14-x}$ or a lower bound of 5 clearly shown, eg $x>5$ as part of the answer
			$5<x\leq 14$	5	A1	cao
						Total 7 marks