WORKED SOLUTIONS

Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9–1)

Centre Number | | | | | |

Candidate Number | | | | |

LPGS Autumn Mock Exam 2020

Time: 1 hour 30 minutes | Paper Reference **1MA1/2H**

Mathematics

Paper 2 (Calculator)
Higher Tier

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided.
  - *there may be more space than you need.*
- You must **show all your working.**
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may be used.**

Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  - *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

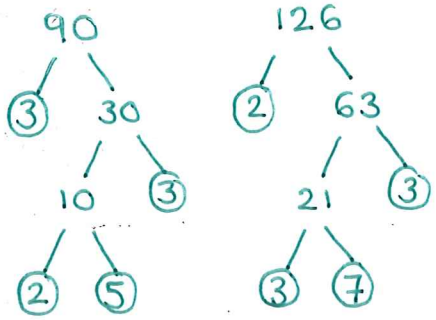
S66511A

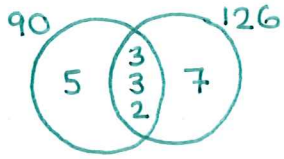
Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Find the highest common factor (HCF) of 90 and 126





HCF = 3 × 3 × 2

= 18

M1 18 included as a factor for either number OR two complete factor trees

Use FACT button on calculator to get all prime factors

M1 at least 5 correct factors for each OR all prime factors of 90 OR " " " " 126

A1 cao

18

(Total for Question 1 is 3 marks)

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2 (a) Simplify $2a^3 \times a^4$

$2a^7$ B1 cao

(1)

(b) Simplify $12x^5y^2 \div 3x^2y$

M1 any two correct from 4, x^3 or y

$4x^3y$ A1 cao

(2)

(Total for Question 2 is 3 marks)

---

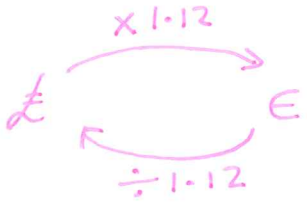
3 Joe went on holiday to Spain.

His flights cost a total of £320

Joe stayed in an apartment for 3 weeks.
The apartment cost 560 euros each week.

Joe hired a car for 15 days.
The car hire cost 20.16 euros each day.

The exchange rate was £1 = 1.12 euros.



(a) Work out the total cost, in pounds, of the flights, the apartment and the car hire.

Flights = £320

Apartment = €560 × 3 = €1680

€1680 ÷ 1·12 = £1500

Car = €20.16 × 15 = €302.40

€302.40 ÷ 1·12 = £270

Total = 320 + 1500 + 270

= £2090

P1 process to convert any value in Euros into pounds

P1 process to find total cost in € or £

P1 complete process to find total cost in £

A1 cao

£ 2090

(4)

(b) If there had been more than 1.12 euros to £1, how would this affect your answer to part (a)?

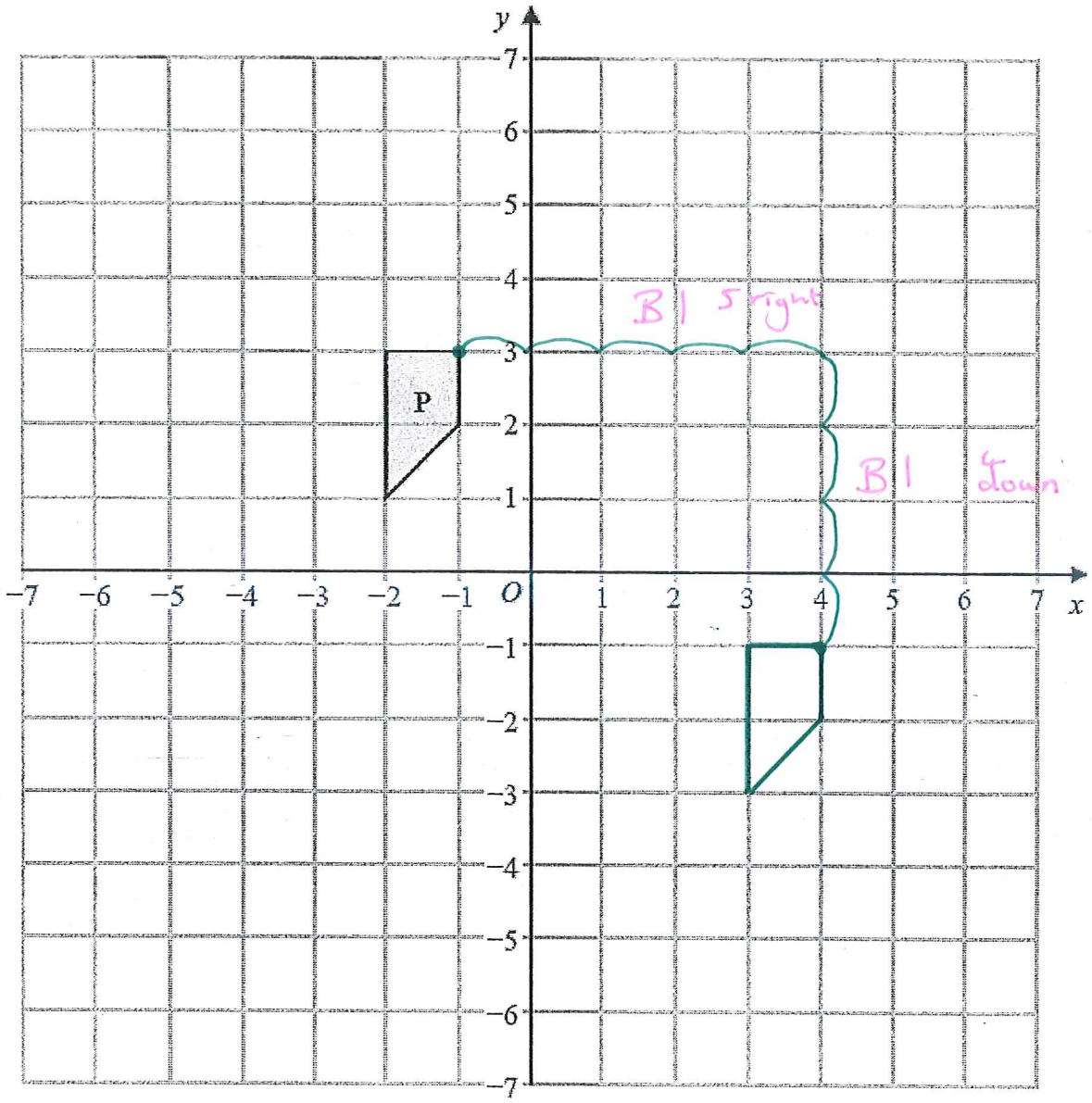
My answer would be lower as you would get more euros per pound

C1

(1)

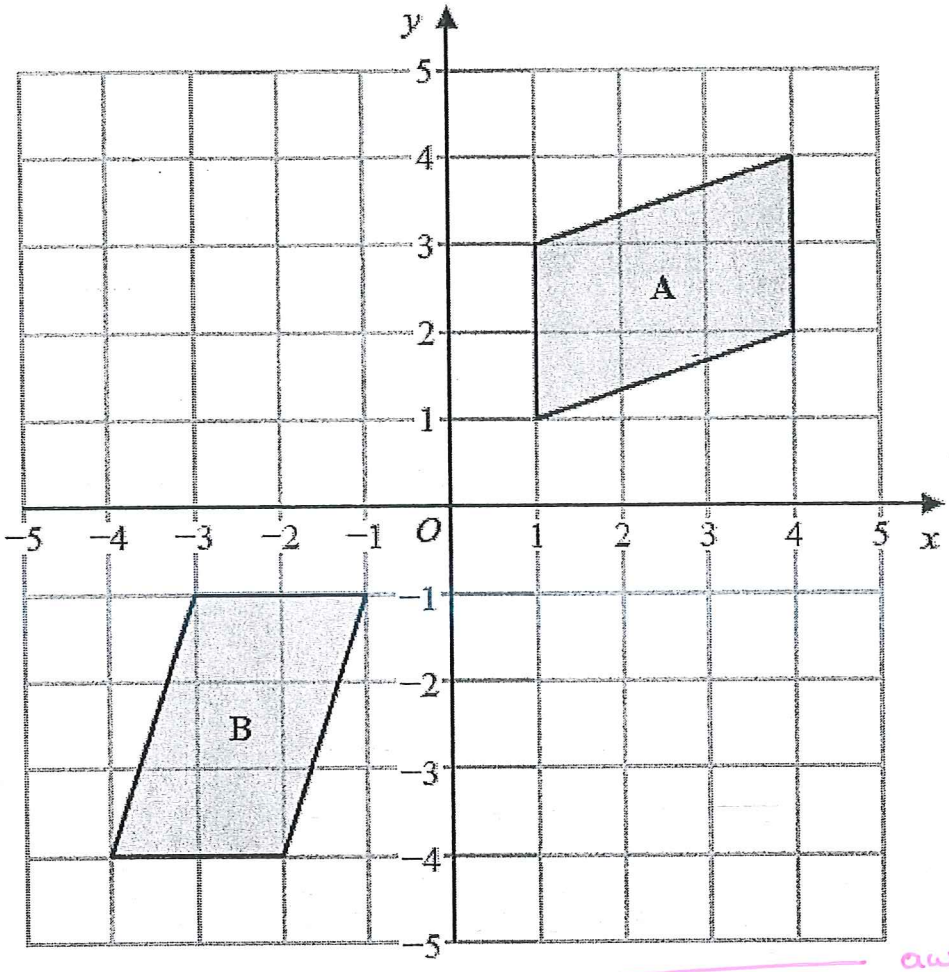
(Total for Question 3 is 5 marks)

4



(a) Translate shape **P** by the vector $\begin{pmatrix} 5 \\ -4 \end{pmatrix}$

(2)



award zero marks if more than one transformation given

(b) Describe fully the single transformation that maps shape **A** onto shape **B**.

Reflection in the line $y = -x$

B1 B1

(2)

(Total for Question 4 is 4 marks)

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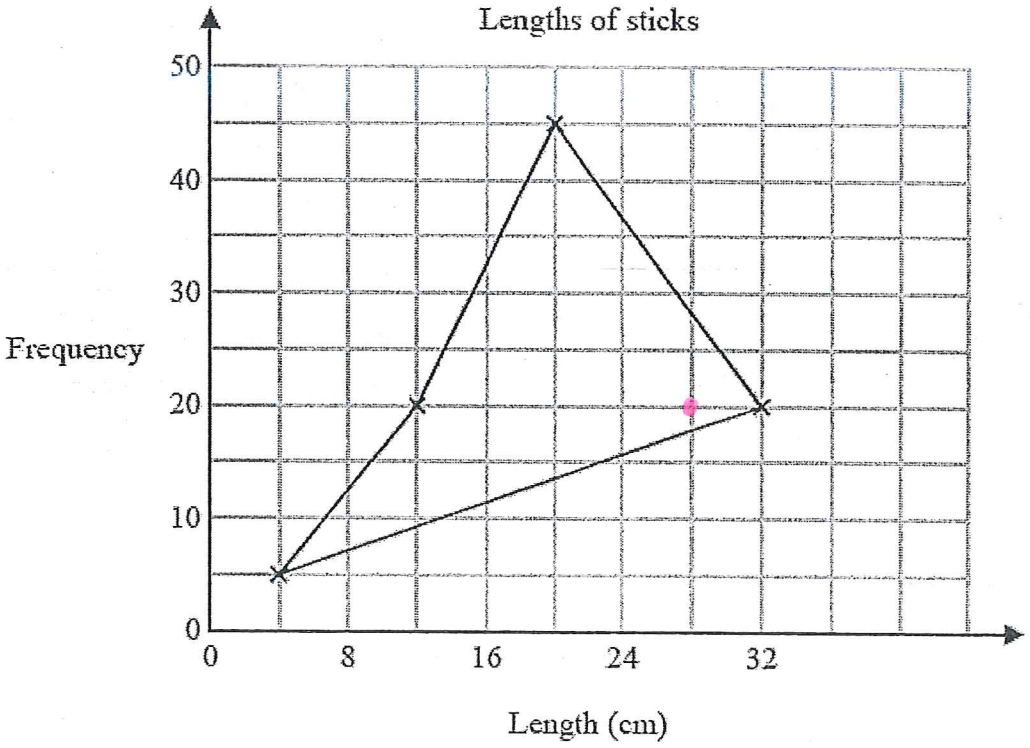
5 The table gives information about the length of each of 90 sticks.

Length (b cm)	Frequency
$0 < b \leqslant 8$	5
$8 < b \leqslant 16$	20
$16 < b \leqslant 24$	45
$24 < b \leqslant 32$	20

Jenny drew the frequency polygon below for the information in the table.
The frequency polygon is **not** correct.



Write down **two** things that are wrong with the frequency polygon.

1 ...The...start...(4,5)...and...end...(32,20)...should...not...be..... C1

...joined.....

2 ...The...point...at...(32,20)...should...be...at...(28,20)...as...it.....

...should...be...in...the...middle...of...the...group..... C1

(Total for Question 5 is 2 marks)

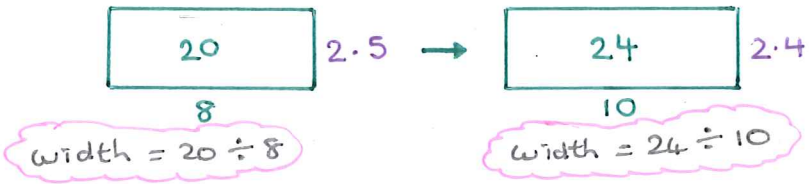
6 A rectangle has length 8 cm
The rectangle has area 20 cm^2

The length of the rectangle is increased by 2 cm
The area of the rectangle is increased by 4 cm^2

Noah says,

"The width of the rectangle decreases by less than 5%"

Is Noah correct?
You must show how you get your answer.



width = 20 ÷ 8

width = 24 ÷ 10

$\frac{0.1}{2.5} \times 100 = 4\%$

% decrease
$= \frac{\text{actual decrease}}{\text{original amount}} \times 100$

$= \frac{2.5 - 2.4}{2.5} \times 100$

$= \frac{0.1}{2.5} \times 100$

$= 4\%$

Yes, Noah is correct. The width decreases by 4%.

P1 process to find either width of rectangle
P1 process to find % change in width
C1 Yes with fully correct figures

(Total for Question 6 is 3 marks)

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7 $a : b = 2 : 3$
$b : c = 5 : 6$

Show that $a : c = 5 : 9$

let b = 15 :

C1 use common multiple of 3 and 5

a	:	b
2	:	3
10	:	15

(×5)

b	:	c
5	:	6
15	:	18

(×3)

a : b : c
10 : 15 : 18

C1
So a : c = 10 : 18 = 5 : 9

(Total for Question 7 is 2 marks)

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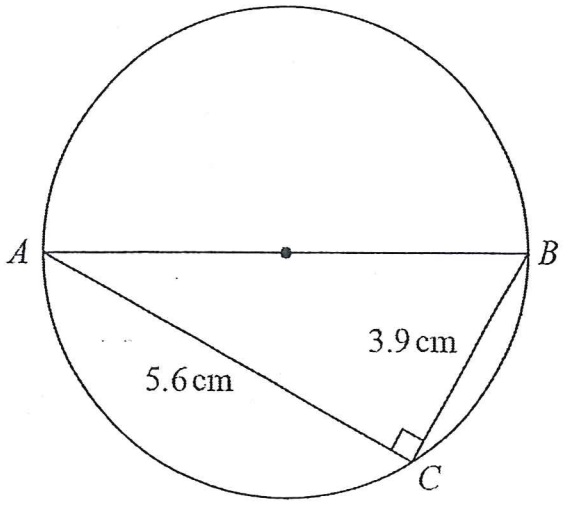
8 A, B and C are points on a circle with diameter AB.
ABC is a right-angled triangle.



Calculate the area of the circle.
Give your answer correct to 3 significant figures.

$AB^2 = 3.9^2 + 5.6^2$ P1

$= 46.57$

$AB = 6.824\ldots$ cm P1

radius $= \frac{1}{2} AB = 3.412\ldots$

Area $= \pi r^2$

$= \pi \times 3.412\ldots^2$ P1

$= 36.575\ldots$

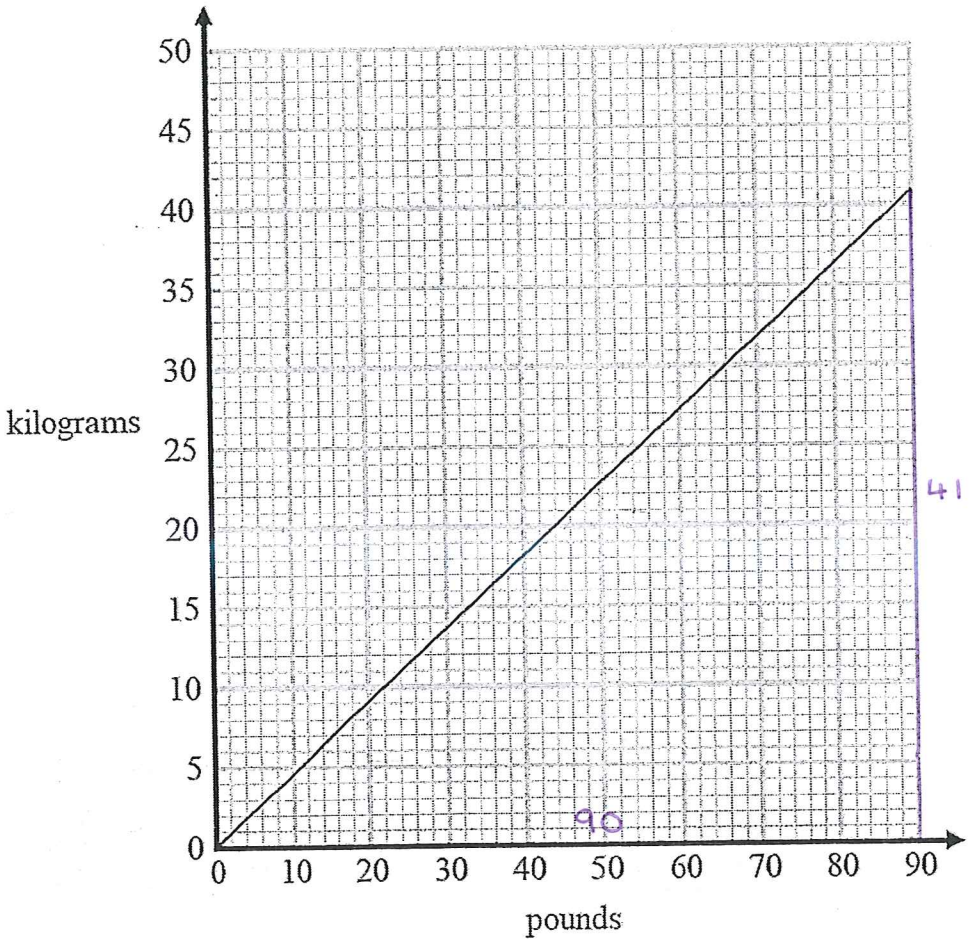
$= 36.6$ cm^2 (3s.f.)

A1 36.2 to 36.6

36.6 ..... cm^2

(Total for Question 8 is 4 marks)

9 This graph can be used to convert between kilograms and pounds.



(a) Work out the gradient of the straight line.

gradient $= \frac{41}{90} = 0.46$ (2dp)

M1

0.4 to 0.5

A1

0.46

(2)

(b) What does the gradient of this line represent?

The number of kilograms in one pound

C1

(1)

(Total for Question 9 is 3 marks)

10 The table gives some information about the times taken by 80 students to complete a test.

Time (t minutes)	Frequency
$20 < t \leqslant 25$	4
$25 < t \leqslant 30$	16
$30 < t \leqslant 35$	30
$35 < t \leqslant 40$	18
$40 < t \leqslant 45$	12

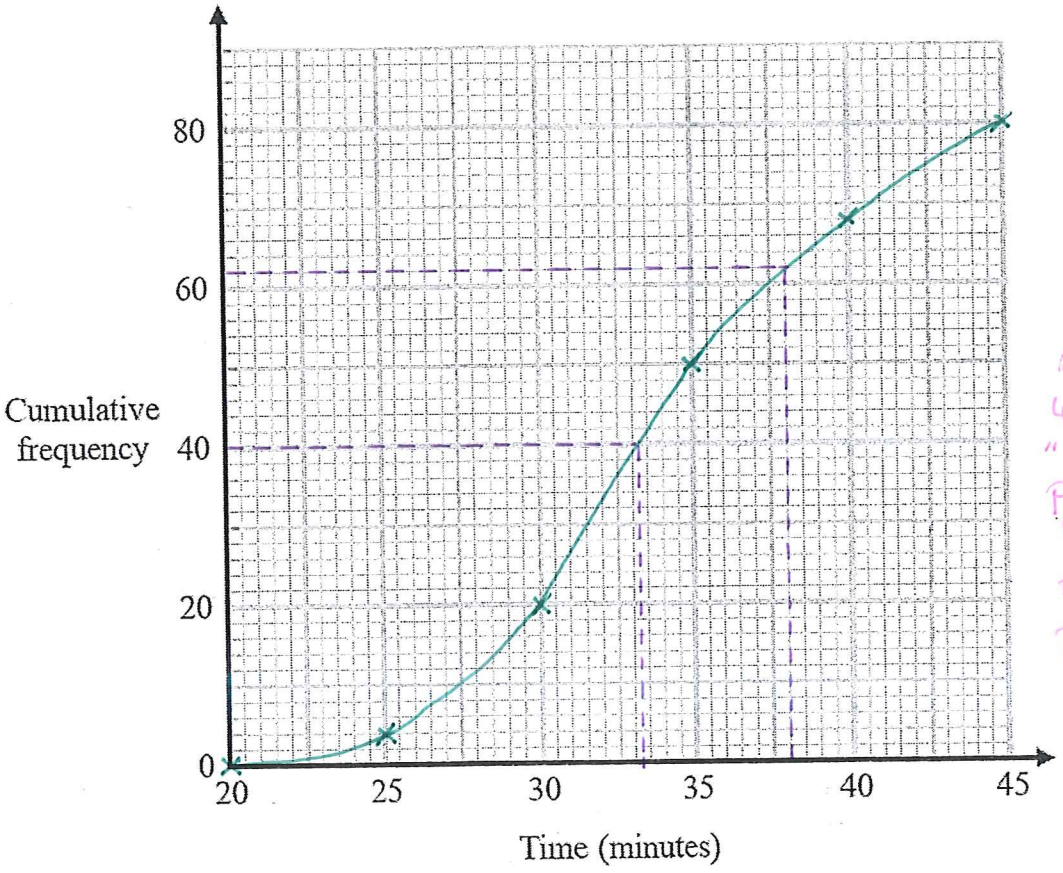
(a) Complete the cumulative frequency table for this information.

Time (t minutes)	Cumulative frequency
$20 < t \leqslant 25$	4
$20 < t \leqslant 30$	20
$20 < t \leqslant 35$	50
$20 < t \leqslant 40$	68
$20 < t \leqslant 45$	80

B1

(1)

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



M1 4 or 5 of "their" points plotted correctly.
A1 fully correct cf graph.

(2)

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

32.5 → 34 B1

.....33.25..... minutes

(1)

One of the students is chosen at random.

(d) Use your graph to find an estimate for the probability that this student took longer than 38 minutes to complete the test.

80 − 62 = 18

M1 $\frac{80 - \text{"n"}}{80}$

$\frac{18}{80} = \frac{9}{40}$

0.2 → 0.275 A1

$\frac{9}{40}$

.....

(2)

(Total for Question 10 is 6 marks)

11 Lisa bought a house.

The value of the house increased by 1.5% each year for 2 years.
At the end of 2 years, the value of the house was £123 627

Work out the value of the house when Lisa bought it.

original price $\xrightarrow{\times 1.015^2}$ New price

£120,000 $\xleftarrow{\div 1.015^2}$ £123,627

M1 (use of $\div 1.015$)

A1

£ 120,000

(Total for Question 11 is 2 marks)

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12 Expand and simplify $(x + 5)(x - 3)(x + 4)$

$= (x + 5)(x^2 - 3x + 4x - 12)$

$= (x + 5)(x^2 + x - 12)$

$= x^3 + x^2 - 12x + 5x^2 + 5x - 60$

$= x^3 + 6x^2 - 7x - 60$

M1
method to find product of any two linear expressions (3 or 4 terms correct ignoring signs)

M1
ft multiplying out remaining products

A1 cao

$x^3 + 6x^2 - 7x - 60$

(Total for Question 12 is 3 marks)

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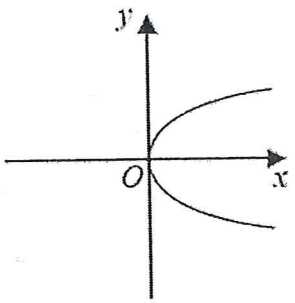
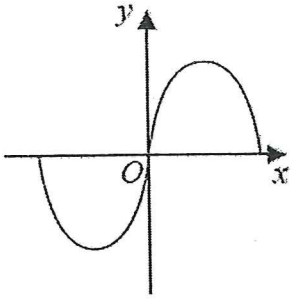
13 Here are nine graphs.



A



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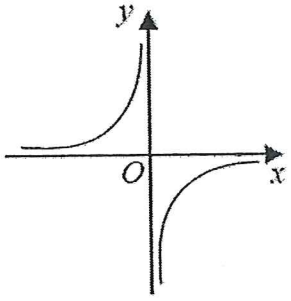

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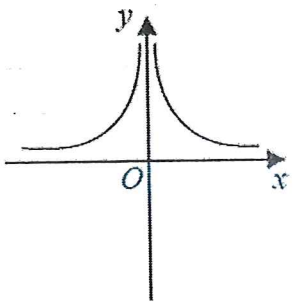

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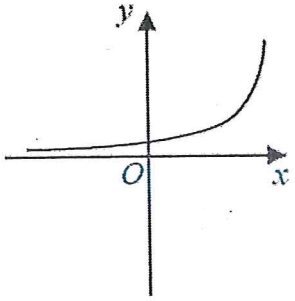

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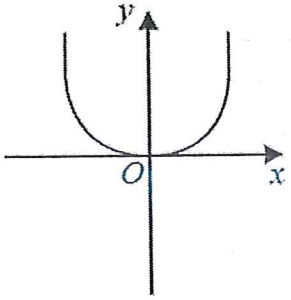

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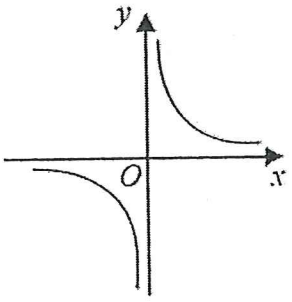
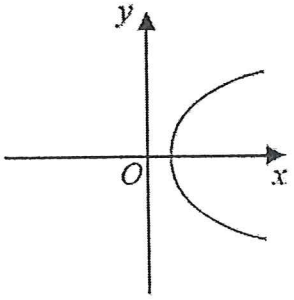
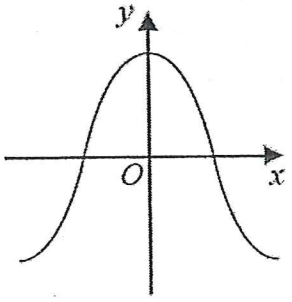


G



H



I

(a) Write down the letter of the graph that could have the equation $y = \cos x°$

I B1

.....

(1)

(b) Write down the letter of the graph that could have the equation $y = \frac{4}{x^2}$

D B1

.....

(1)

(c) Write down the letter of the graph that could have the equation $y^2 = 4x$

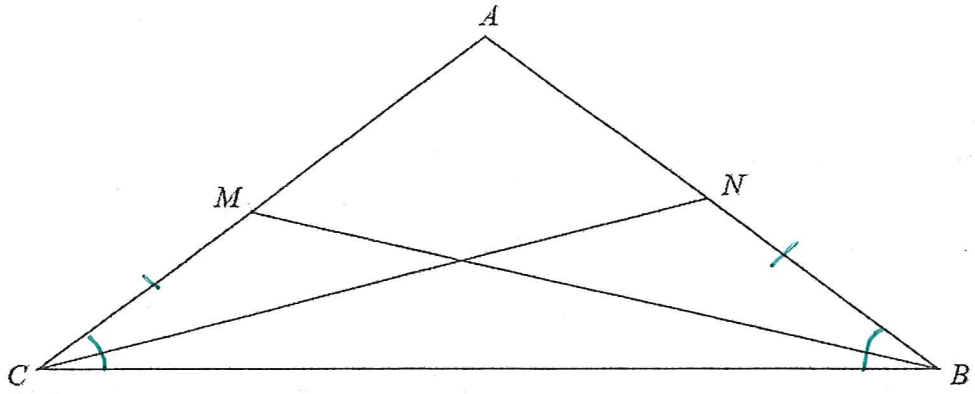
A B1

.....

(1)

(Total for Question 13 is 3 marks)

14 The diagram shows an isosceles triangle ABC with $AB = AC$.



M is the midpoint of AC.
N is the midpoint of AB.

Prove that triangle MBC is congruent to triangle NCB.

- $N\hat{B}C = M\hat{C}B$ (base angles of an isosceles triangle are equal). C1
- $MC = \frac{1}{2}AC$, $NB = \frac{1}{2}AB$

  $\therefore MC = NB$ as $AC = AB$. C1
- CB is a shared side. C1 complete proof with SAS as condition

$\therefore$ MBC and NCB are congruent by SAS (side, angle, side).

(Total for Question 14 is 3 marks)

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15 g is a function such that

$$g(x) = x^3 + 1$$

(a) Find g(–3) $= (-3)^3 + 1$

$= -27 + 1 = -26$

.....-26..... B1

(1)

(b) Find $g^{-1}(x)$ $x = y^3 + 1$

$-1]$ $x - 1 = y^3$ M1

$\sqrt[3]{\ }]$ $\sqrt[3]{x-1} = y$ A1 cao

.....$g^{-1}(x) = \sqrt[3]{x-1}$.....

(2)

$x \xrightarrow{\text{cube}} x^3 \xrightarrow{+1} x^3+1$

$\sqrt[3]{x-1} \xleftarrow{\sqrt[3]{\ }} x-1 \xleftarrow{-1} x$

(Total for Question 15 is 3 marks)

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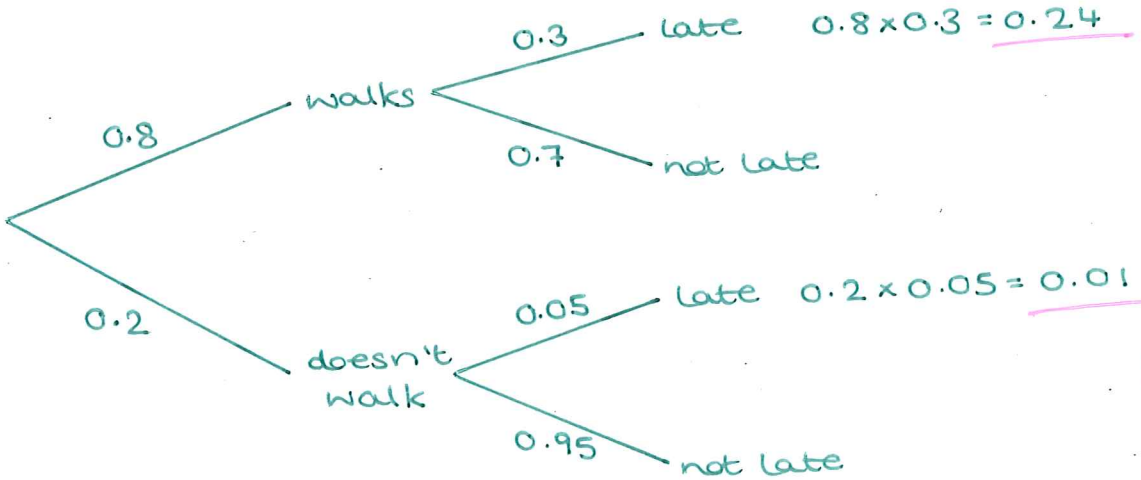
16 The probability that Saira walks to school is 0.8

If Saira walks to school, the probability that she will be late is 0.3
If Saira does **not** walk to school, the probability that she will be late is 0.05

Work out an estimate for the number of days that Saira will be late on the next 20 school days.



$0.8 \times 0.3 = 0.24$

$0.2 \times 0.05 = 0.01$ P1 (either)

P(late) $= 0.24 + 0.01 = 0.25$ P1

$0.25 \times 20 = 5$

.....5..... A1

(Total for Question 16 is 3 marks)

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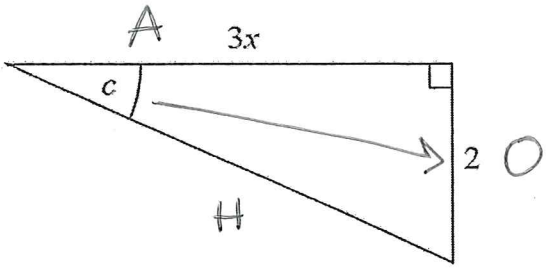
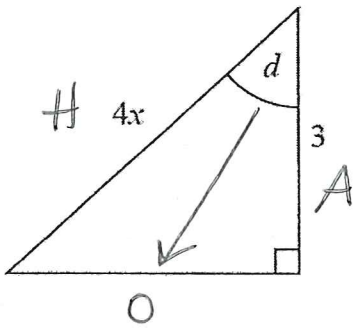
17 Here are two right-angled triangles.



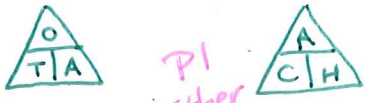


The lengths of the sides are given in centimetres.

Given that

$$\tan c + \cos d = 1.5$$

find the size of angle c.
Give your answer correct to the nearest degree.



P1 either

$\tan c = \frac{2}{3x}$ $\cos d = \frac{3}{4x}$

$\tan c + \cos d = 1.5$

$\frac{2}{3x} + \frac{3}{4x} = 1.5$

$\times 12x$ $\quad 8 + 9 = 18x$

$17 = 18x$ P1

$\div 18$ $\quad x = \frac{17}{18}$

$\frac{2^{\times 4}}{3x^{\times 4}} + \frac{3^{\times 3}}{4x^{\times 3}} = 1.5$

$\frac{8}{12x} + \frac{9}{12x} = 1.5$

$\frac{17}{12x} = 1.5$ $\quad [\times 12x$

$17 = 18x$ $\quad [\div 18$

$\frac{17}{18} = x$

$\tan c = \frac{2}{3 \times \frac{17}{18}} = \frac{12}{17}$ P1

$c = \tan^{-1}\left(\frac{12}{17}\right) = 35.217\ldots$

$= 35°$ (2 s.f.)

A1

35 °

angle between 35 and 36

(Total for Question 17 is 4 marks)

18 Here are the first five terms of a quadratic sequence.

1 8 21 40 65

The nth term of this sequence can be written in the form $an^2 + bn$, where a and b are integers.

Work out the value of a and the value of b.

1 8 21 40 65

+7 +13 +19 +25

+6 +6 +6

$3n^2$: 3 12 27 48 75

-2 -4 -6 -8 -10

-2 -2 -2 -2

$-2n$: -2 -4 -6 -8 -10

M1 method to find value of a

M1 method to find value of b

$a =$ 3 A1 both cao

$b =$ -2

(Total for Question 18 is 3 marks)

Maths Watch method

$2a = 6$

$a = 3$

$3a + b = 7$

$3 \times 3 + b = 7$

$9 + b = 7$

$b = -2$

$a + b + c = 1$

$3 - 2 + c = 1$

$1 + c = 1$

$c = 0$

19 $T = \frac{m}{f}$

m = 120 correct to 3 significant figures

f = 25.6 correct to 1 decimal place

By considering bounds, work out the value of T to a suitable degree of accuracy.
Give a reason for your answer.
You must show all your working.

M1 any one correct bound

$m = 120$ → l.b. = 119.5, u.b. = 120.5

$f = 25.6$ → l.b. = 25.55, u.b. = 25.65

l.b. of $T = \frac{119.5}{25.65} = 4.6588693\ldots = 4.7$ (1dp)

M1 either A1 both

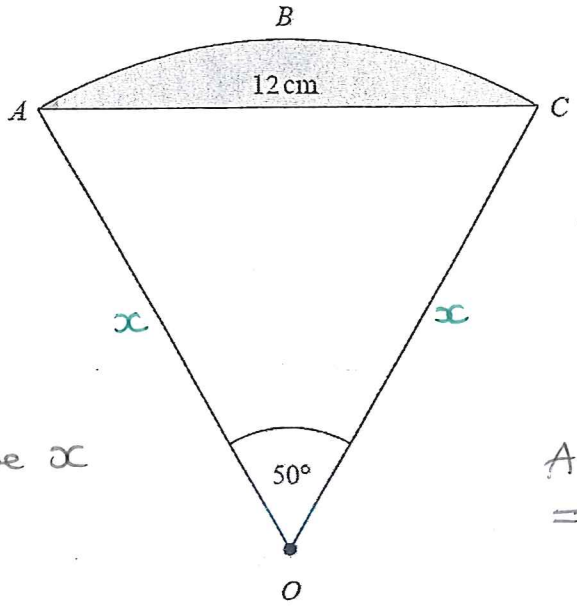
u.b. of $T = \frac{120.5}{25.55} = 4.7162426\ldots = 4.7$ (1dp)

u.b. and l.b. agree to 1 decimal place. C1

T = 4.7 (1dp)

(Total for Question 19 is 4 marks)

20 *OABC* is a sector of a circle with centre *O*.



let the radius be x

Area Sector $= \frac{\theta}{360} \times \pi r^2$

Area Triangle $= \frac{1}{2} ab \sin C$

Area Shaded segment = Area Sector − Area Triangle

Angle $AOC = 50°$
$AC = 12$ cm

Work out the area of the shaded segment of the circle.
Give your answer correct to 3 significant figures.

$a^2 = b^2 + c^2 - 2bc\cos A$

$12^2 = x^2 + x^2 - 2 \times x \times x \times \cos 50$

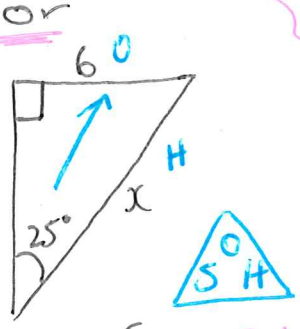
$144 = 2x^2 - 2x^2 \cos 50$

$= 2x^2(1 - \cos 50)$

$2x^2 = \frac{144}{1 - \cos 50}$

$\div 2]$ $x^2 = \frac{72}{1 - \cos 50} = 201.56\ldots$ $x = \sqrt{201.56\ldots} = 14.197\ldots$

or



$x = \frac{6}{\sin 25}$ P1

radius $= 14.1972\ldots$ P1

Shaded area $= \frac{50}{360} \times \pi \times 14.197\ldots^2 - \frac{1}{2} \times 14.197\ldots \times 14.197\ldots \sin 50$ P1

$= 10.745\ldots$

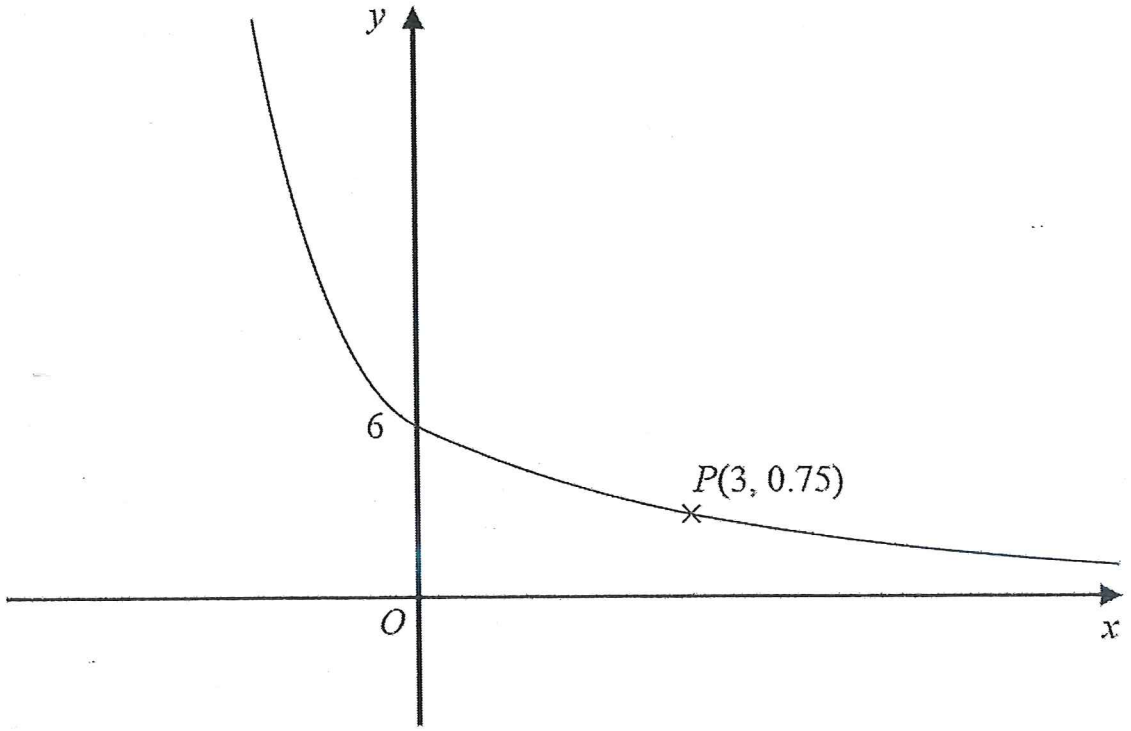
$= 10.7$ cm² (3 s.f.) A1

..... 10.7 ..... cm²

$10.6 \rightarrow 10.9$

(Total for Question 20 is 5 marks)

21 The diagram shows a sketch of the graph with equation $y = ab^{-x}$



P is a point on the graph with coordinates (3, 0.75)

Work out the value of a and the value of b.

(0,6): $6 = ab^0 = a$ $\quad a = 6$ m1 $\quad b^0 = 1$

(3,0.75): $0.75 = 6 \times b^{-3}$ m1

$\div 6$] $\quad \frac{1}{8} = b^{-3}$

$\frac{1}{8} = \frac{1}{b^3}$

$b^3 = 8$

$b = 2$

$a =$ 6 A1 both

$b =$ 2

(Total for Question 21 is 3 marks)

22 **A**, **B** and **C** are three similar solids.

The surface area of **A** is 24 cm^2
The surface area of **B** is 54 cm^2

The height of **B** : the height of **C** = 3 : 7
The volume of **A** is 72 cm^3

C is made of wood with density 0.14 g/cm^3

Work out the mass of **C**.

Mass = Density × Volume

Area scale factor A → B = $\frac{54}{24} = \frac{9}{4}$

∴ length scale factor A → B = $\frac{3}{2}$

Lengths : A : B : C
2 : 3 : 7

∴ length scale factor A → C = $\frac{7}{2}$ P1

volume scale factor A → C = $(\frac{7}{2})^3 = \frac{343}{8}$ P1

Volume C = $72 \times \frac{343}{8}$ = 3087 cm^3 P1

mass C = 3087 × 0.14 = 432.18 g P1

	A	B	C
height		$\times \frac{3}{2}$ →	$\times \frac{7}{3}$ →
Area	24 cm^2	$\times \frac{9}{4}$ → 54 cm^2	$\times \frac{49}{9}$ →
Volume	72 cm^3	$\times \frac{27}{8}$ → 243 cm^3	$\times \frac{343}{27}$ → 3087 cm^3
Density			0.14 g/cm^3

Mass C = Density × Volume
= 3087 × 0.14

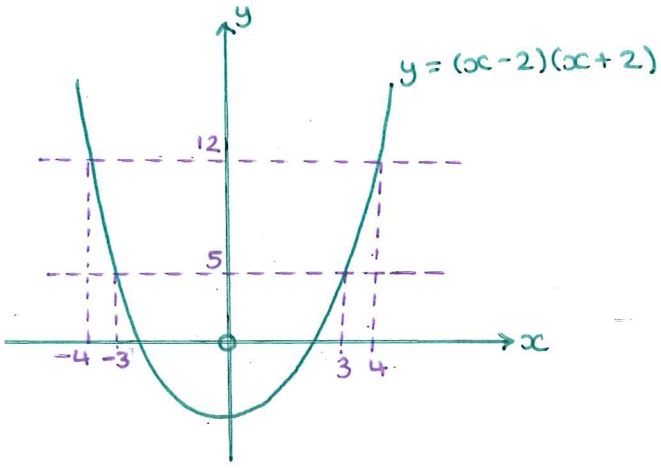
432 → 432.2

.....432.18..... g A1

(Total for Question 22 is 5 marks)

23 Solve $5 < (x-2)(x+2) < 12$

You must show all your working.



$(x-2)(x+2) = 5$

$x^2 - 4 = 5$ M1 (either)

+4] $x^2 = 9$

√] $x = \pm 3$ M1

$(x-2)(x+2) = 12$

$x^2 - 4 = 12$

+4] $x^2 = 16$

√] $x = \pm 4$

$5 < (x-2)(x+2) < 12$

$-4 < x < -3$ or $3 < x < 4$

M1 A1

$-4 < x < -3$ or $3 < x < 4$

(Total for Question 23 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS