

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
Time 1 hour 30 minutes		Paper reference	1MA1/1H
Mathematics PAPER 1 (Non-Calculator) Higher Tier			
You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, Formulae Sheet (enclosed). 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 not 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.
- Good luck with your examination.

Turn over ►

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Pearson

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 Solve $7x - 27 < 8$

$$\begin{array}{rcl} & +27 & +27 \\ 7x & < & 35 \\ \div 7 & & \div 7 \end{array} \quad \begin{array}{l} \checkmark \textcircled{1} \\ \checkmark \textcircled{1} \end{array}$$

$$x < 5$$

(Total for Question 1 is 2 marks)

- 2 Write 124 as a product of its prime factors.

$$\begin{array}{c} 124 \\ / \quad \backslash \\ \textcircled{2} \quad 62 \\ \quad / \quad \backslash \\ \quad \textcircled{2} \quad \textcircled{31} \end{array} \quad \checkmark \textcircled{1}$$

$$2^2 \times 31 \quad \checkmark \textcircled{1}$$

$$2^2 \times 31$$

(Total for Question 2 is 2 marks)



- 3 A delivery company has a total of 160 cars and vans.

the number of cars : the number of vans = 3 : 7

Each car and each van uses electricity or diesel or petrol.

$\frac{1}{8}$ of the cars use electricity.

25% of the cars use diesel.

The rest of the cars use petrol.

Work out the number of cars that use petrol.

You must show all your working.

$$\begin{array}{ccc} \text{cars} & : & \text{vans} & & \text{total} \\ 3 & : & 7 & \rightarrow & 10 \end{array}$$

$$160 \text{ vehicles} \div 10 = 16 \quad \checkmark \textcircled{1}$$

$$\begin{array}{ccc} 3 & : & 7 \\ \times 16 \downarrow & & \times 16 \end{array}$$

$$48 \text{ cars} : 112 \text{ vans} \quad \checkmark \textcircled{1}$$

$$\text{Petrol} : 1 - \frac{1}{8} - \frac{1}{4} = \frac{5}{8} \quad \checkmark \textcircled{1}$$

$$\frac{5}{8} \times 48 = 30 \quad \checkmark \textcircled{1}$$

$\checkmark \textcircled{1}$

30

(Total for Question 3 is 5 marks)



- 4 (a) Write 1.63×10^{-3} as an ordinary number.

••• 1 63

✓ ①
0.00163

(1)

- (b) Write 438 000 in standard form.

4.38 000

5 jumps to get 4.38

✓ ①
 4.38×10^5

(1)

- (c) Work out $(4 \times 10^3) \times (6 \times 10^{-5})$
Give your answer in standard form.

collect like terms

$4 \times 6 \times 10^3 \times 10^{-5}$ ✓ ①
 24×10^{-2} ↓ add powers

2.4×10^{-1} ✓ ①

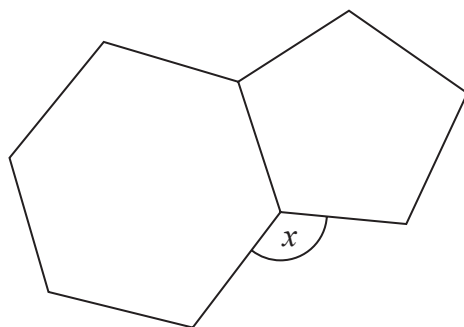
2.4×10^{-1}

(2)

(Total for Question 4 is 4 marks)



- 5 Here is a regular hexagon and a regular pentagon.

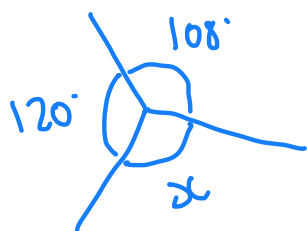


Work out the size of the angle marked x .
You must show all your working.

interior angle formula : $\frac{(n-2) \times 180}{n}$

hexagon : $\frac{4 \times 180}{6} = 120^\circ$ ✓ ①

pentagon : $\frac{3 \times 180}{5} = 108^\circ$ ✓ ①



$$360^\circ = 120^\circ + 108^\circ + x^\circ$$

$$x^\circ = 132^\circ$$
 ✓ ①

132°

(Total for Question 5 is 3 marks)



- 6 (a) Complete the table of values for $y = x^2 - 3x + 1$

x	-1	0	1	2	3	4
y	5	1	-1	-1	1	5

$$y = (-1)^2 - (3 \times -1) + 1$$

$$= 1 + 3 + 1$$

$$= 5$$

$$2^2 - 6 + 1$$

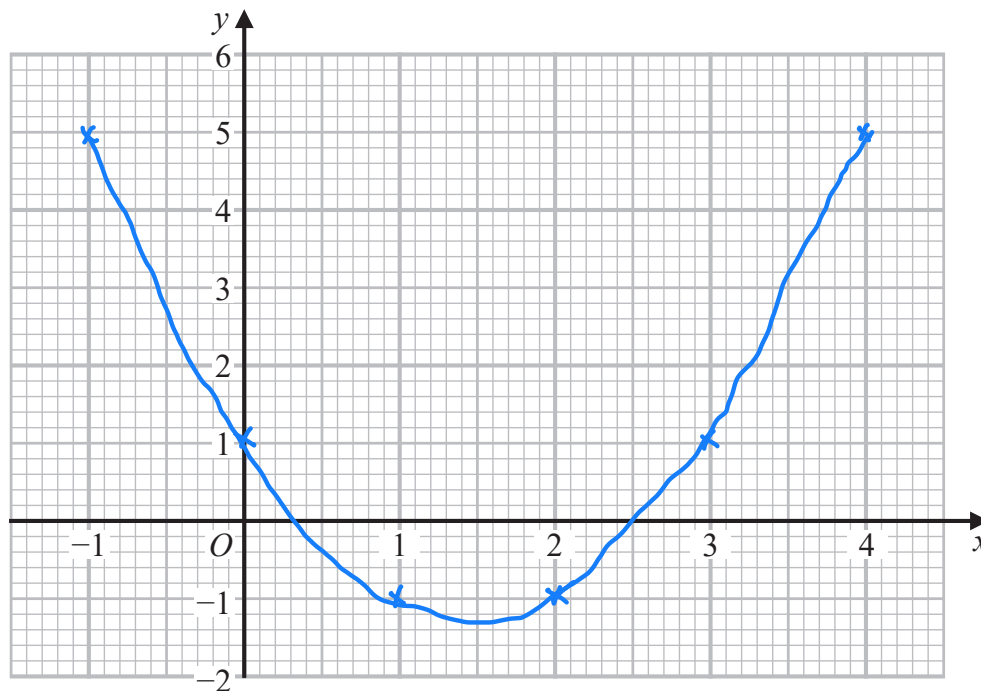
$$= -1$$

$$3^2 - 9 + 1$$

$$= 1$$

(2)

- (b) On the grid, draw the graph of $y = x^2 - 3x + 1$ for values of x from -1 to 4



(2)

- (c) Using your graph, find estimates for the solutions of the equation $x^2 - 3x + 1 = 0$

solutions when $y = 0$

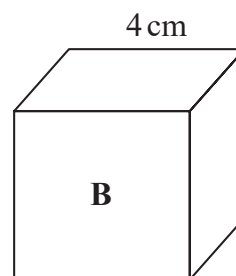
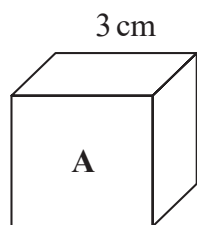
$$x = 2.5 \text{ or } x = 0.35$$

(2)

(Total for Question 6 is 6 marks)



7 Here are two cubes, **A** and **B**.



Cube **A** has a mass of 81 g.

Cube **B** has a mass of 128 g.

Work out

the density of cube **A** : the density of cube **B**

Give your answer in the form $a : b$, where a and b are integers.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

$$\text{density A : } \frac{81}{3^3} \checkmark \textcircled{1} = \frac{81}{27} = 3$$

$$\text{density B : } \frac{128}{4^3} = 2 \checkmark \textcircled{1}$$

$$\text{ratio A : B} \quad 3 : 2 \quad \checkmark \textcircled{1} \quad \dots\dots\dots 3 : 2$$

(Total for Question 7 is 3 marks)



- 8 The table shows the amount of snow, in cm, that fell each day for 30 days.

Amount of snow (s cm)	Frequency
$0 \leq s < 10$	8
$10 \leq s < 20$	10
$20 \leq s < 30$	7
$30 \leq s < 40$	2
$40 \leq s < 50$	3

Work out an estimate for the mean amount of snow per day.

frequency $\times$ midpoint

$$8 \times 5 + 10 \times 15 + 7 \times 25 + 2 \times 35 + 3 \times 45$$

$$40 + 150 + 175 + 70 + 135$$

$$= 570$$

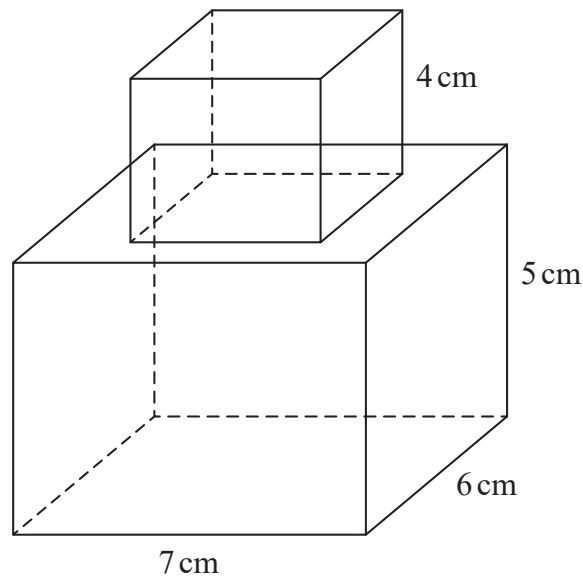
$$570 \div 30 \text{ days} = 19 \text{ mean}$$

19 cm

(Total for Question 8 is 3 marks)



- 9 A cube is placed on top of a cuboid, as shown in the diagram, to form a solid.



The cube has edges of length 4 cm.

The cuboid has dimensions 7 cm by 6 cm by 5 cm.

Work out the total surface area of the solid.

split into 2 shapes

Cuboid:

top: 6×7 (with a 4×4 hole)

bottom: 6×7

sides: $2 \times (6 \times 5)$

front/back: $2 \times (7 \times 5)$

✓ ①

$$7 \times 6 - 4 \times 4 + 6 \times 7 + 2 \times 6 \times 5 + 2 \times 7 \times 5$$

$$42 - 16 + 42 + 60 + 70$$

$$= 198 \quad \checkmark$$

Cube: top + sides + front + back

$$4^2 + 2 \times 4^2 + 2 \times 4^2$$

$$= 80 \quad \checkmark \text{ ①}$$

Total = $198 + 80 = 278$ cm²

(Total for Question 9 is 3 marks)



- 10 The table shows some information about the profit made each day at a cricket club on 100 days.

Profit (£ x)	Frequency
$0 \leq x < 50$	10
$50 \leq x < 100$	15
$100 \leq x < 150$	25
$150 \leq x < 200$	30
$200 \leq x < 250$	5
$250 \leq x < 300$	15

- (a) Complete the cumulative frequency table.

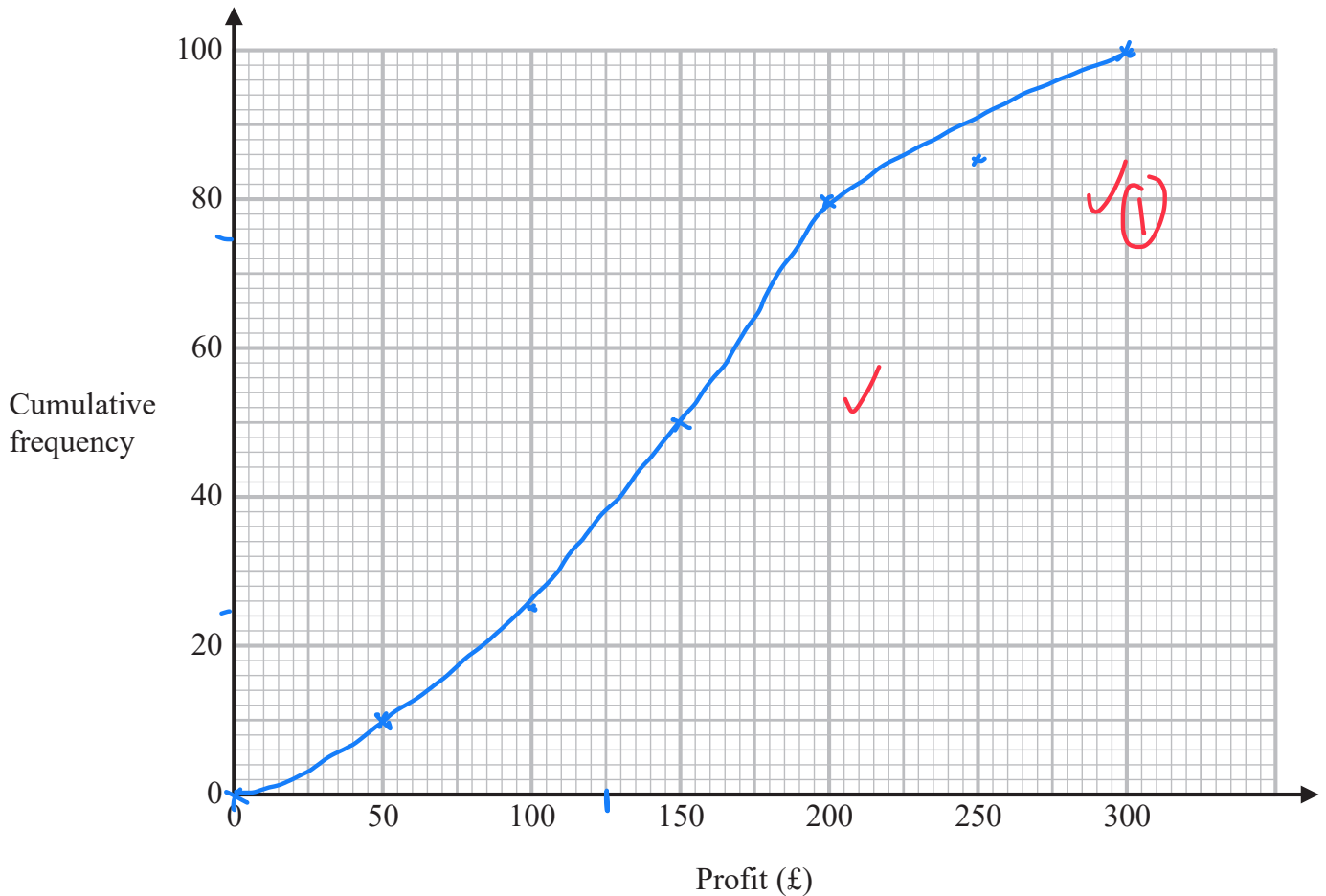
Profit (£ x)	Cumulative frequency
$0 \leq x < 50$	10
$0 \leq x < 100$	25
$0 \leq x < 150$	50
$0 \leq x < 200$	80
$0 \leq x < 250$	85
$0 \leq x < 300$	100

✓ ①

(1)



(b) On the grid, draw a cumulative frequency graph for this information.



(2)

(c) Use your graph to find an estimate for the number of days on which the profit was less than £125

at £125, days are 36 ✓ ① 36 days
(1)

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

day 25 to 75
£100 191 ✓ ①
 $191 - 100 = 91$ ✓ ① £ 91
(2)

(Total for Question 10 is 6 marks)



- 11 Cormac has some sweets in a bag.

The sweets are lime flavoured or strawberry flavoured or orange flavoured.

In the bag

number of lime : number of strawberry : number of orange
flavoured sweets : flavoured sweets : flavoured sweets = 9 : 4 : x

Cormac is going to take at random a sweet from the bag.

The probability that he takes a lime flavoured sweet is $\frac{3}{7}$

Work out the value of x.

L : S : O

9 : 4 : x

Total

9 + 4 + x or 13 + x

Lime

$$\frac{9}{13+x} = \frac{3}{7} \quad \checkmark \textcircled{1}$$

$$63 = 39 + 3x \quad \checkmark \textcircled{1}$$

$$24 = 3x \quad \text{so} \quad x = 8 \quad \checkmark \textcircled{1}$$

$$x = 8$$

(Total for Question 11 is 3 marks)

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- 12 Express $0.1\dot{1}\dot{7}$ as a fraction.
You must show all your working.

$$\text{let } x = 0.1\dot{1}\dot{7} \quad \checkmark \textcircled{1}$$

$$x = 0.1171717 \dots$$

get rid of the repeating decimals

$$100x = 11.71717 \quad \text{subtract}$$

$$x = 0.11717$$

$$\hline \quad \checkmark \textcircled{1}$$

$$99x = 11.6$$

$$\quad \checkmark \textcircled{1}$$

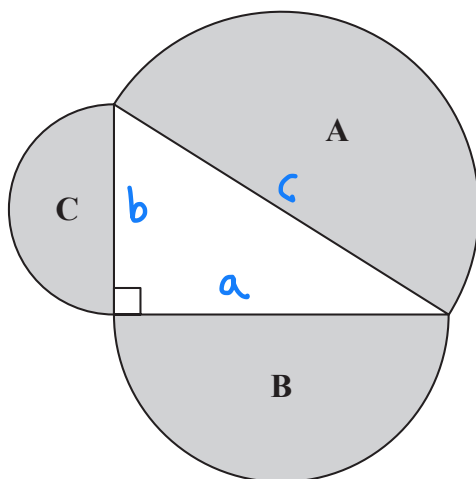
$$x = \frac{11.6}{99} = \frac{116}{990}$$

$$\frac{116}{990}$$

(Total for Question 12 is 3 marks)



- 13 A right-angled triangle is formed by the diameters of three semicircular regions, **A**, **B** and **C** as shown in the diagram.



area 
 $\frac{1}{2} \times \pi \times r^2$

Show that

$$\text{area of region A} = \text{area of region B} + \text{area of region C}$$

right angled Δ : lengths $a^2 + b^2 = c^2$ ✓ ①

area B : $\frac{1}{2} \times \pi \times \left(\frac{a}{2}\right)^2 = \frac{a^2 \pi}{8}$

area C : $\frac{1}{2} \times \pi \times \left(\frac{b}{2}\right)^2 = \frac{b^2 \pi}{8}$

area B+C : $\frac{a^2 \pi}{8} + \frac{b^2 \pi}{8}$ ✓ ①
 factor out $\frac{\pi}{8} (a^2 + b^2)$

$a^2 + b^2 = c^2$, so substitute $\frac{\pi}{8} c^2$

area A : $\frac{1}{2} \times \pi \times \left(\frac{c}{2}\right)^2 = \frac{\pi}{8} c^2$ ✓ ①
 they match

(Total for Question 13 is 3 marks)

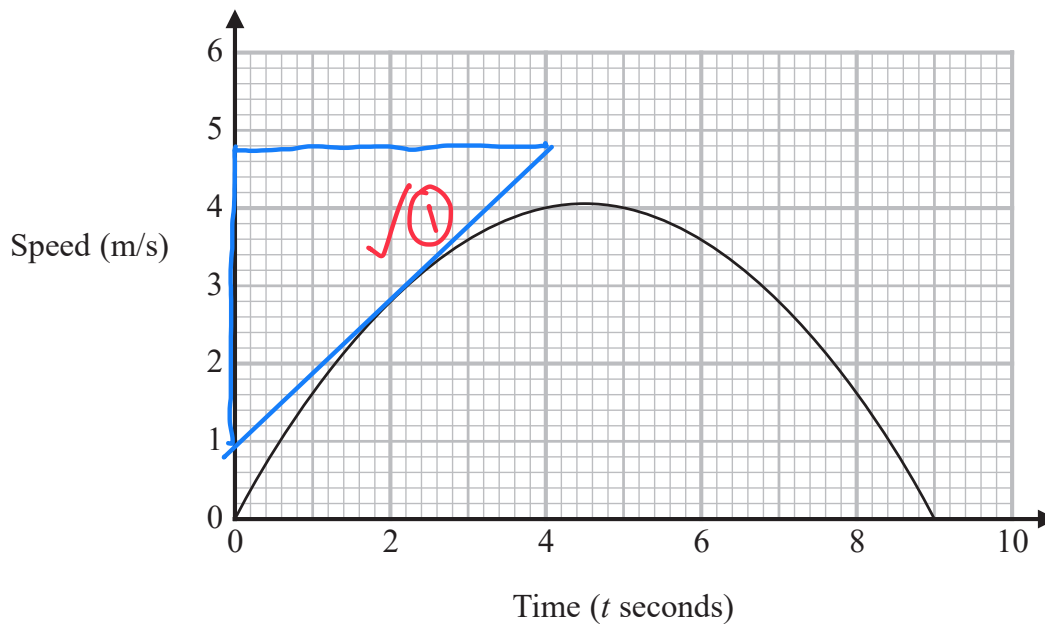
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14 Here is a speed-time graph.



(a) Work out an estimate of the gradient of the graph at $t = 2$

tangent at $t=2$

$$\frac{\text{change in } y}{\text{change in } x} = \frac{4.8 - 1}{4 - 0} = 0.95$$

0.95
(3)

(b) What does the area under the graph represent?

speed $\times$ time = distance travelled

(1)

(Total for Question 14 is 4 marks)



15 A , B and C are three points such that

$$\vec{AB} = 3\mathbf{a} + 4\mathbf{b}$$

$$\vec{AC} = 15\mathbf{a} + 20\mathbf{b}$$

(a) Prove that A , B and C lie on a straight line.

factor and common point

$$\begin{aligned} \vec{AB} &= 3\mathbf{a} + 4\mathbf{b} \\ \vec{AC} &= 5(3\mathbf{a} + 4\mathbf{b}) \quad \checkmark (1) \end{aligned}$$

$\vec{AC}$ is a multiple of $\vec{AB}$ and they share point A $\checkmark (1)$

(2)

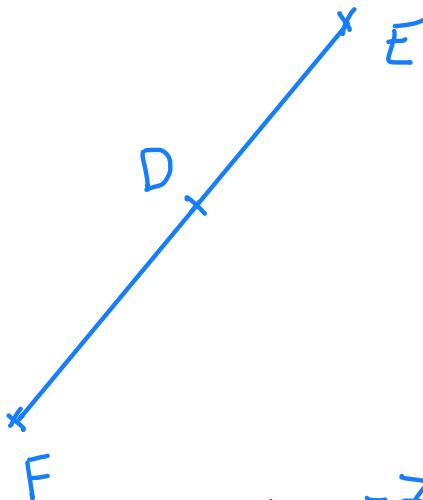
D , E and F are three points on a straight line such that

$$\vec{DE} = 3\mathbf{e} + 6\mathbf{f}$$

$$\vec{EF} = -10.5\mathbf{e} - 21\mathbf{f}$$

(b) Find the ratio

length of DF : length of DE



$$\begin{aligned} \vec{DF} &= \vec{DE} + \vec{EF} \\ &= 3\mathbf{e} + 6\mathbf{f} + -10.5\mathbf{e} + -21\mathbf{f} \\ &\text{collect e and f} \\ &= -7.5\mathbf{e} - 15\mathbf{f} \quad \checkmark (1) \end{aligned}$$

$$\vec{DF} : \vec{DE}$$

$$\begin{aligned} -7.5\mathbf{e} - 15\mathbf{f} : 3\mathbf{e} + 6\mathbf{f} \\ \text{factor out } \downarrow \\ -2.5(3\mathbf{e} + 6\mathbf{f}) : 3\mathbf{e} + 6\mathbf{f} \\ \div 3\mathbf{e} + 6\mathbf{f} \quad \div 3\mathbf{e} + 6\mathbf{f} \end{aligned}$$

negative answer
just means
opposite direction

$$\begin{aligned} -2.5 : 1 \quad \checkmark (1) \\ -5 : 2 \end{aligned}$$

$$5:2$$

(3)

(Total for Question 15 is 5 marks)



- 16 A first aid test has two parts, a theory test and a practical test.
The probability of passing the theory test is 0.75
The probability of passing only one of the two parts is 0.36

The two events are independent. *multiply them*

Work out the probability of passing the practical test.

$$P \text{ pass theory} = 0.75$$

$$\text{fail theory} = 1 - 0.75 = 0.25 \quad \checkmark \textcircled{1}$$

$$\text{Pass one of 2 parts} = 0.36$$

pass theory, fail practical

$$0.75 \times y$$

let fail practical = y

pass practical, fail theory

$$(1-y) \times 0.25 \quad \checkmark \textcircled{1}$$

$$0.75y + 0.25(1-y) = 0.36$$

$$0.75y + 0.25 - 0.25y = 0.36 \quad \checkmark \textcircled{1}$$

collect terms

$$0.5y = 0.11$$

$$y = \frac{0.11}{0.5} = 0.22$$

y was to fail practical
pass = $1 - 0.22 = 0.78$
 $0.78 \quad \checkmark \textcircled{1}$

(Total for Question 16 is 4 marks)



- 17 y is directly proportional to the square root of t .
 $y = 15$ when $t = 9$

t is inversely proportional to the cube of x .
 $t = 8$ when $x = 2$

Find a formula for y in terms of x .
 Give your answer in its simplest form.

$$\textcircled{1} \quad y = k\sqrt{t}$$

$$15 = k\sqrt{9}$$

$$15 = 3k \quad \text{so} \quad k = 5$$

$$\Rightarrow y = 5\sqrt{t} \quad \checkmark \textcircled{1}$$

$$\textcircled{2} \quad t = \frac{K}{x^3}$$

$$8 = \frac{K}{2^3} \quad \text{so} \quad K = 64 \Rightarrow t = \frac{64}{x^3} \quad \checkmark \textcircled{1}$$

y in terms of x , substitute out t

$$y = 5\sqrt{t}$$

$$y^2 = 25t$$

$$t = \frac{y^2}{25}$$

$$\frac{y^2}{25} = \frac{64}{x^3} \quad \checkmark \textcircled{1}$$

$$y^2 = \frac{64 \times 25}{x^3}$$

$$y = \frac{\sqrt{64 \times 25}}{\sqrt{x^3}}$$

$$y = \frac{8 \times 5}{\sqrt{x^3}} = \frac{40}{\sqrt{x^3}} \quad \checkmark \textcircled{1}$$

(Total for Question 17 is 4 marks)

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18 Work out the value of $\frac{\left(5\frac{4}{9}\right)^{-\frac{1}{2}} \times \left(4\frac{2}{3}\right)}{2^{-3}}$

You must show all your working.

simplify fractions first

$$\frac{\left(\frac{49}{9}\right)^{-1/2} \times \frac{14}{3}}{2^{-3}}$$

a - power flips the fraction

$$\left(\frac{3}{7} \times \frac{14}{3}\right) \div \frac{1}{8}$$

$$\frac{\cancel{3} \times 14}{7 \times \cancel{3}} \times 8$$

3's cancel
7's cancel

left with 2×8
 $= 16$

16

(Total for Question 18 is 4 marks)



19 Solve $\frac{1}{2x-1} + \frac{3}{x-1} = 1$

Give your answer in the form $\frac{p \pm \sqrt{q}}{2}$ where p and q are integers.

$$\frac{1}{2x-1} + \frac{3}{x-1} = 1$$

cross multiply

$$\frac{1(x-1) + 3(2x-1)}{(2x-1)(x-1)} = 1 \quad \checkmark \textcircled{1}$$

$$x-1 + 6x-3 = (2x-1)(x-1)$$

$$7x-4 = 2x^2-3x+1$$

$$0 = 2x^2 - 10x + 5 \quad \checkmark \textcircled{1}$$

quadratic formula

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{10 \pm \sqrt{(-10)^2 - (4 \times 2 \times 5)}}{2 \times 2} \quad \checkmark \textcircled{1}$$

$$= \frac{10 \pm \sqrt{100 - 40}}{4}$$

$$\frac{10 \pm \sqrt{60}}{4}$$

$\div 2$

$$\frac{5 \pm \sqrt{15}}{2} \quad \checkmark \textcircled{1}$$

$$\frac{5 \pm \sqrt{15}}{2}$$

roots can only $\div$ with roots. Have to do

$$\sqrt{60} \div \sqrt{4} = \sqrt{15}$$

(Total for Question 19 is 4 marks)

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20 The centre of a circle is the point with coordinates $(-1, 3)$

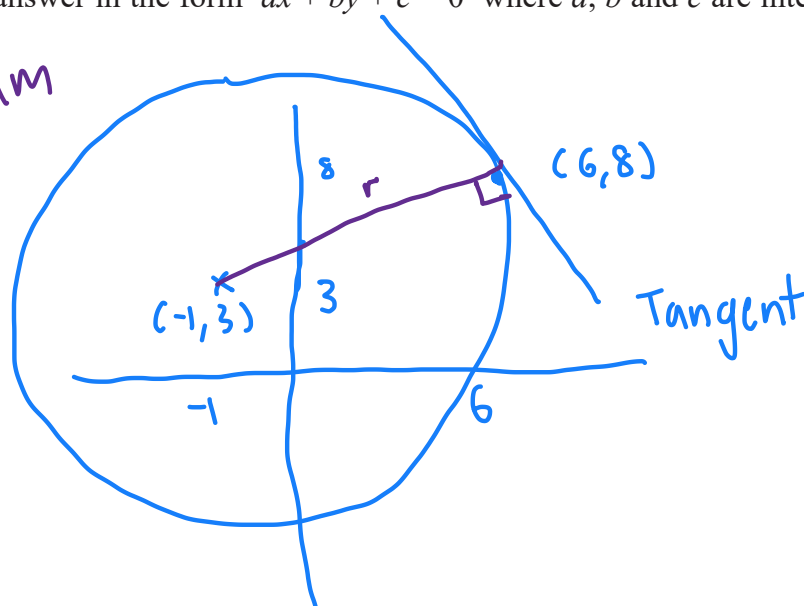
The point A with coordinates $(6, 8)$ lies on the circle.

Find an equation of the tangent to the circle at A .

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

$$(x+1)^2 + (y-3)^2 = r^2$$

Diagram



the gradients of the radius and tangent are perpendicular

$$m_{\text{radius}} \rightarrow \frac{\Delta y}{\Delta x} = \frac{8-3}{6-(-1)} = \frac{5}{7} \quad \checkmark \textcircled{1}$$

$$m_{\text{TANGENT}} \rightarrow -\frac{7}{5} \quad \checkmark \textcircled{1} \quad (\text{negative reciprocal of radius})$$

$$y - y_1 = m(x - x_1) \quad \rightarrow \text{tangent hits } (6, 8)^{x, y}$$

$$y - 8 = -\frac{7}{5}(x - 6) \quad \checkmark \textcircled{1}$$

$$5y - 40 = -7(x - 6) \quad \checkmark \textcircled{1}$$

$$5y - 40 = -7x + 42$$

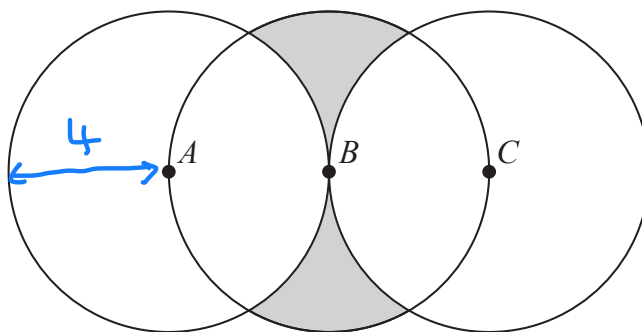
$$7x + 5y - 82 = 0 \quad \checkmark \textcircled{1}$$

(Total for Question 20 is 4 marks)



21 The diagram shows three circles, each of radius 4 cm.

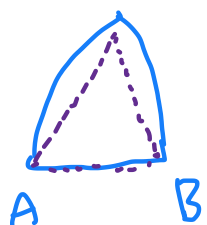
The centres of the circles are A , B and C such that ABC is a straight line and $AB = BC = 4$ cm.



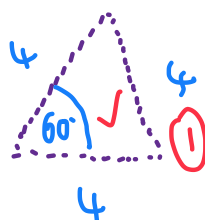
Work out the total area of the two shaded regions.
Give your answer in terms of π

shaded = middle circle
- white areas

white areas $\Rightarrow 4 \times$



split into



and $2 \times$ segment

$$\text{triangle area} = \frac{1}{2} \times 4 \times 4 \times \sin 60 \left(\frac{\sqrt{3}}{2} \right) = 4\sqrt{3} \quad \checkmark \textcircled{1}$$

$$\text{one segment} = 4^2 \pi \times \frac{60^\circ}{360^\circ} - \frac{1}{2} \times 4 \times 4 \times \sin 60 \quad \checkmark \textcircled{1}$$

$$\text{one white area} \Rightarrow 4\sqrt{3} + 2 \left(\frac{16\pi}{6} - 4\sqrt{3} \right)$$

$$\triangle = \frac{16\pi}{3} - 4\sqrt{3} \quad \checkmark \textcircled{1}$$

$$\text{Shaded} \Rightarrow \text{middle circle} - 4 \triangle$$

$$16\pi - 4 \left(\frac{16\pi}{3} - 4\sqrt{3} \right) = 16\sqrt{3} - \frac{16\pi}{3} \text{ cm}^2 \quad \checkmark \textcircled{1}$$

(Total for Question 21 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS



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