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 ▶

Pearson

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Solve $7x - 27 < 8$

$+27 \qquad +27$

$\checkmark$①

$7x < 35$

$\div 7 \qquad \div 7$

$x < 5$ $\checkmark$①

$x < 5$

(Total for Question 1 is 2 marks)

2 Write 124 as a product of its prime factors.

124

2   62

2   31 $\checkmark$①

$2^2 \times 31$ $\checkmark$①

$2^2 \times 31$

(Total for Question 2 is 2 marks)

2

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.

cars : vans   total
  3 : 7 → 10

160 vehicles ÷ 10 = 16 ✓①

  3 : 7
 ×16 ↓ ×16

 48 cars : 112 vans
        ✓①

Petrol : $1 - \frac{1}{8} - \frac{1}{4} = \frac{5}{8}$ ✓①

 $\frac{5}{8} \times 48 = 30$ ✓①

                              ✓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.

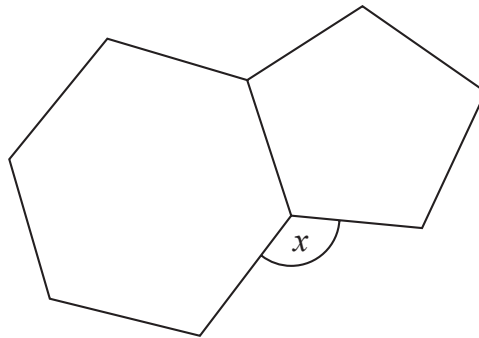collect like terms

$4 \times 6 \times 10^3 \times 10^{-5}$ ✓ ①

24×10^{-2} ↓ add powers

2.4×10^{-1} ✓ ①

2.4×10^{-1}

(2)

(Total for Question 4 is 4 marks)

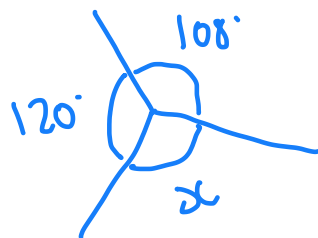**5** Here is a regular hexagon and a regular pentagon.

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

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

hexagon : $\dfrac{4 \times 180}{6} = 120°$ ✓①

pentagon : $\dfrac{3 \times 180}{5} = 108°$ ✓①

$360° = 120° + 108° + x$
$x = 132°$ ✓①

$\overline{\hspace{3cm} 132 \hspace{0.3cm}}$ °

(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

√① $\frac{16 - 12 + 1}{= 5}$

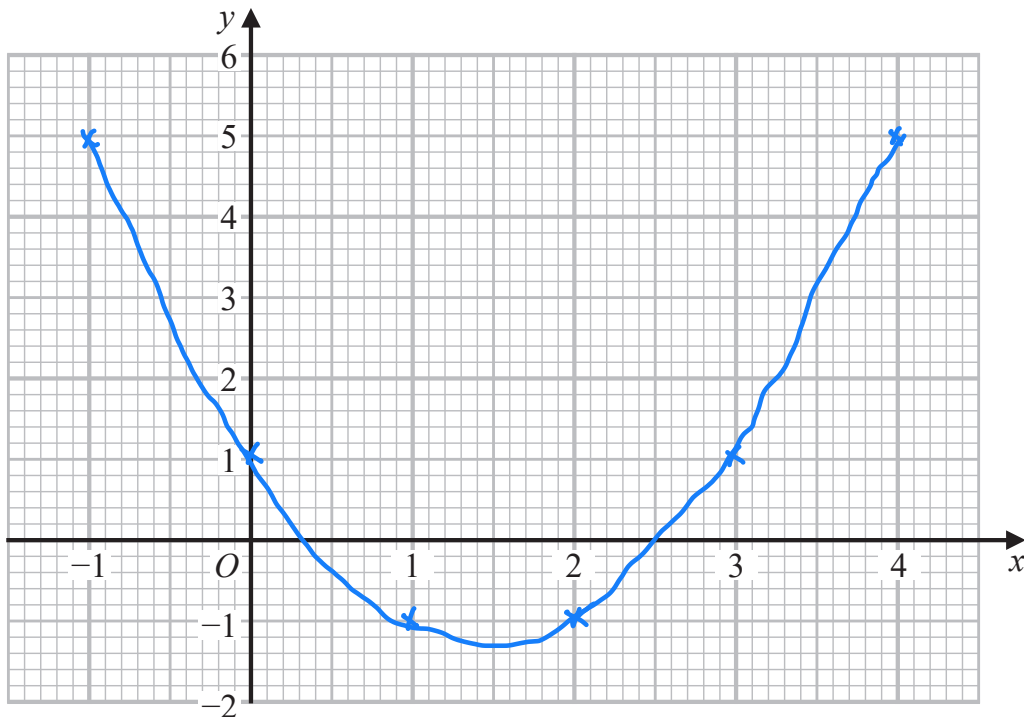$y = (-1)^2 - (3x - 1) + 1$

$= 1 + 3 + 1$

$= 5$

√① ↓

$2^2 - 6 + 1$

$= -1$

$3^2 - 9 + 1$

$= 1$

(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 $x^2 - 3x + 1 = 0$
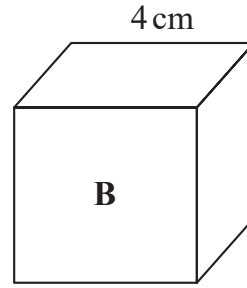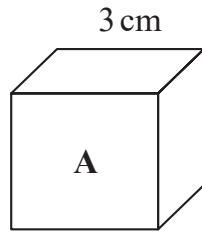
Solutions when $y = 0$ ✓

$x = 2.5$ ① or $x = 0.35$ ①

2.5 , 0.35

(2)

(Total for Question 6 is 6 marks)

6

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

3 cm

A

4 cm

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.

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

$$\text{density A} : \frac{81}{3^3} \checkmark① = \frac{81}{27} = 3$$

$$\text{density B} : \frac{128}{4^3} = 2 \checkmark①$$

ratio A : B $\checkmark①$

3 : 2

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
$0 \leqslant s < 10$	8
$10 \leqslant s < 20$	10
$20 \leqslant s < 30$	7
$30 \leqslant s < 40$	2
$40 \leqslant s < 50$	3

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

frequency × midpoint   ✓①

8 × 5 + 10 × 15 + 7 × 25 + 2 × 35 + 3 × 45

40 + 150 + 175 + 70 + 135

= 570 ✓①

570 ÷ 30 days = 19 mean ✓①

19 .... cm

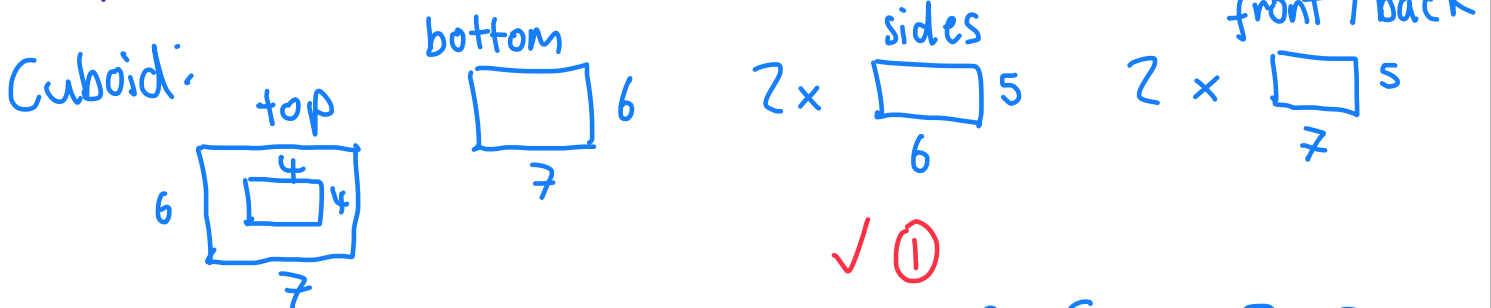**(Total for Question 8 is 3 marks)**

8

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

4 cm

5 cm

6 cm

7 cm
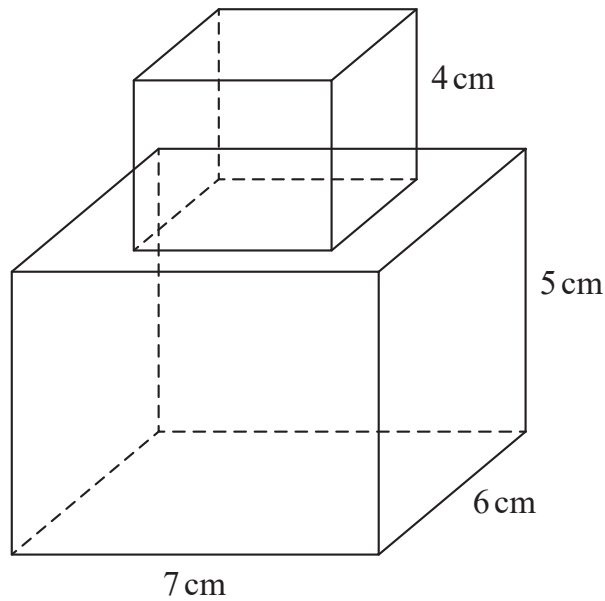
The cube has edges of length 4 cm.
The cuboid has dimensions 7 cm by 6 cm by 5 cm.

Work out the total surface area of the solid.

split into 2 shapes

Cuboid:

top
6
4 4
7

bottom
6
7

sides
$2\times$ 5
6

front / back
$2\times$ 5
7

✓①

$7\times6 - 4\times4 + 6\times7 + 2\times6\times5 + 2\times7\times5$

$42 - 16 + 42 + 60 + 70$

$= 198$ ✓

cube: top + sides + front + back

$4^2 + 2\times4^2 + 2\times4^2$

$= 80$ ✓①

✓① 278

Total $= 198 + 80 = 278$ cm²

(Total for Question 9 is 3 marks)

9

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

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

(a) Complete the cumulative frequency table.

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

✓ ①

(1)

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

Cumulative frequency (vertical axis), Profit (£) (horizontal axis)
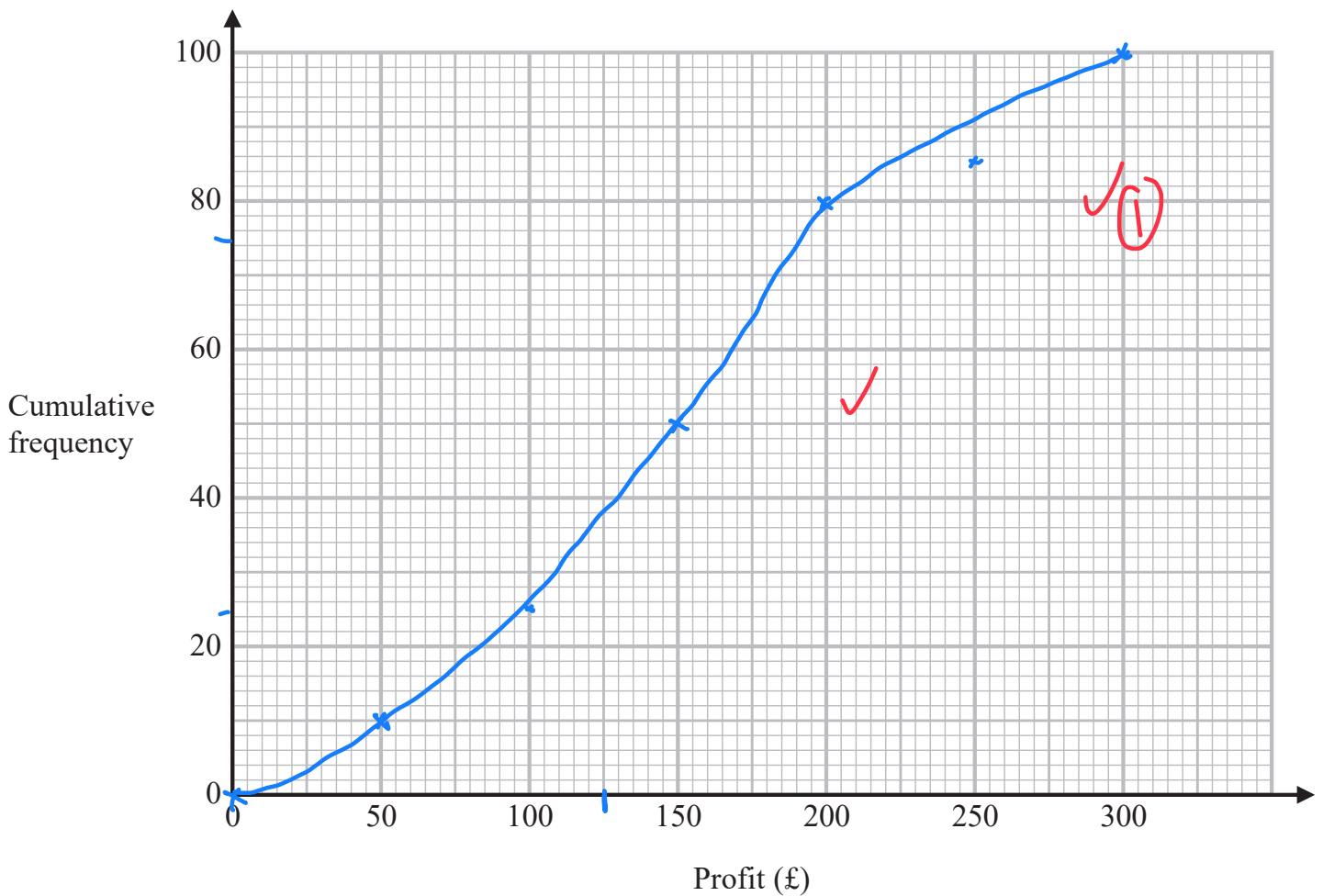
(2)

(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

$$\frac{\text{number of lime}}{\text{flavoured sweets}} : \frac{\text{number of strawberry}}{\text{flavoured sweets}} : \frac{\text{number of orange}}{\text{flavoured sweets}} = 9 : 4 : x$$

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 $\quad \dfrac{9}{13+x} = \dfrac{3}{7}$ ✓①

$63 = 39 + 3x$ ✓①   ✓①

$24 = 3x$ so $x = 8$

$x = $ 8

(Total for Question 11 is 3 marks)

12

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

let $x = 0.1\dot{1}\dot{7}$ ✓①

$x = 0.1171717...$

get rid of the repeating decimals

$100x = 11.71717$ — subtract
$x = 0.11717$
_____ ✓①

$99x = 11.6$

✓①

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

$\dfrac{116}{990}$

(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.
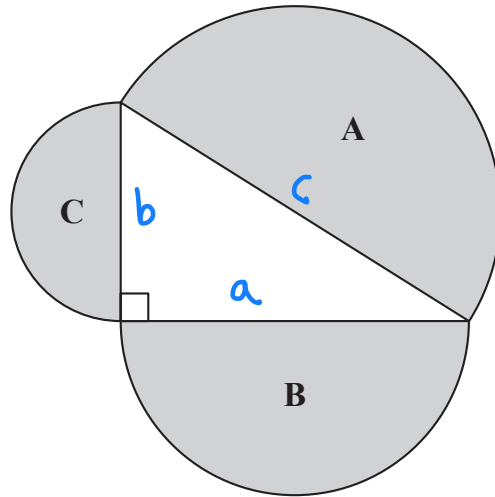
Show that

area of region **A** = area of region **B** + area of region **C**

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

right angled $\triangle$: 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 : $\frac{1}{2} \times \pi \times \left(\frac{b}{2}\right)^2 = \frac{b^2\pi}{8}$
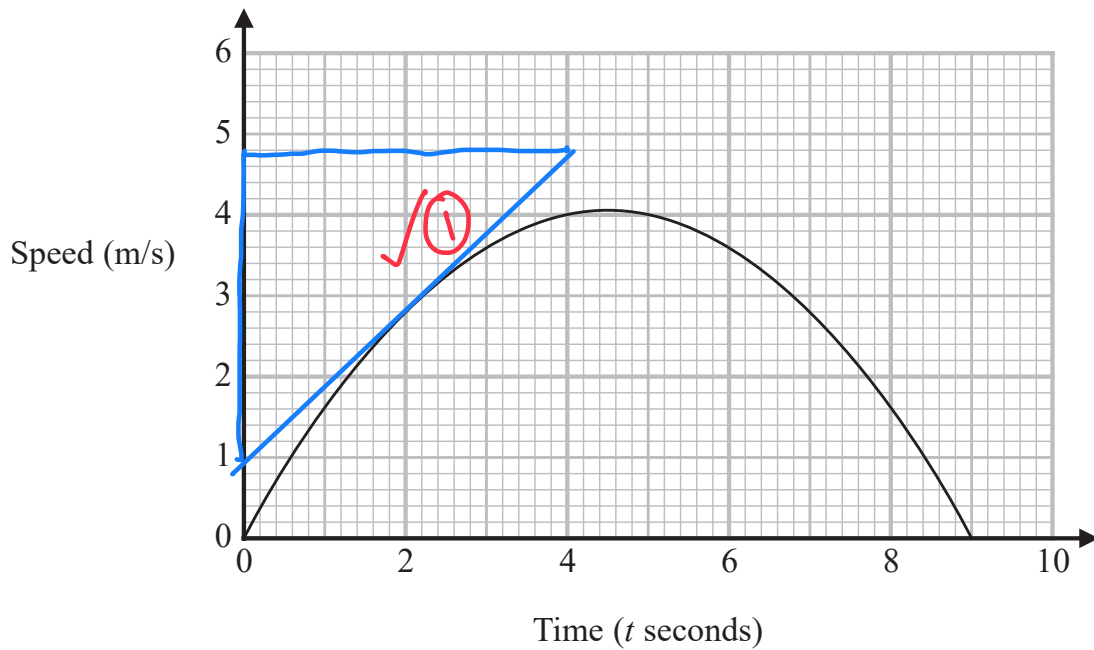
area B+C : $\frac{a^2\pi}{8} + \frac{b^2\pi}{8}$ ✓①

factor out $\frac{\pi}{8}(a^2 + b^2)$

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

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

(Total for Question 13 is 3 marks)

14

14 Here is a speed-time graph.

Speed (m/s)

Time (t seconds)

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

tangent at $t = 2$

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

✓①

0.95

(3)

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

speed × time = distance travelled ✓①

(1)

(Total for Question 14 is 4 marks)

15

15 A, B and C are three points such that

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

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

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

factor and common point

$$\overrightarrow{AB} = 3a + 4b$$
$$\overrightarrow{AC} = 5(3a + 4b) \quad \checkmark①$$

· $\overrightarrow{AC}$ is a multiple of $\overrightarrow{AB}$ and they share point A $\quad \checkmark①$

(2)

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

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

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

(b) Find the ratio

length of DF : length of DE

E

D

F
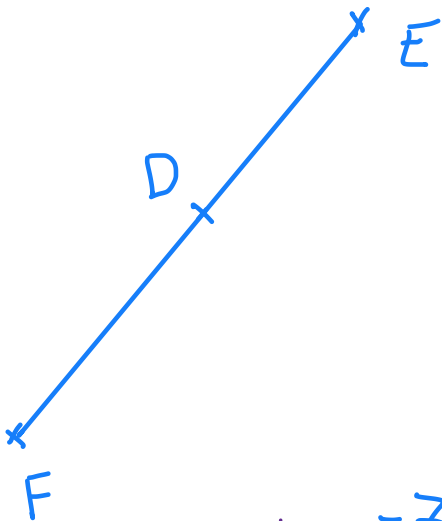
$$\overrightarrow{DF} = \overrightarrow{DE} + \overrightarrow{EF}$$
$$= 3e + 6f + -10.5e + -21f$$
collect e and f
$$= -7.5e - 15f \quad \checkmark①$$

$$\overrightarrow{DF} : \overrightarrow{DE}$$

factor out $\quad -7.5e - 15f : 3e + 6f$

$-2.5(3e + 6f) : 3e + 6f$

$\div 3e + 6f \qquad \div 3e + 6f$

negative answer just means opposite direction

$-2.5 : 1 \quad \checkmark①$

$-5 : 2$

$5 : 2 \quad \checkmark①$

(3)

(Total for Question 15 is 5 marks)

16

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 <u>independent</u>. **multiply them**

Work out the probability of passing the practical test.

P pass theory = 0.75

fail theory = 1 - 0.75 = 0.25 ✓①

Pass one of 2 parts = 0.36

pass theory, fail practical

0.75 × y   let fail practical = y

pass practical, fail theory

(1-y) × 0.25 ✓①

0.75y + 0.25(1-y) = 0.36

0.75y + 0.25 - 0.25y = 0.36 ✓①

collect terms   y was to fail practical

0.5y = 0.11   pass = 1 - 0.22 = 0.78

y = $\frac{0.11}{0.5}$ = 0.22   0.78 ✓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.

① $y = k\sqrt{t}$

$15 = k\sqrt{9}$

$15 = 3k$ so $k = 5$ $\Rightarrow$ $y = 5\sqrt{t}$ ✓ ①

② $t = \dfrac{K}{x^3}$

$8 = \dfrac{K}{2^3}$ so $K = 64$ $\Rightarrow$ $t = \dfrac{64}{x^3}$ ✓ ①

y in terms of x, substitute out t

$y = 5\sqrt{t}$

$y^2 = 25t$

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

$\dfrac{y^2}{25} = \dfrac{64}{x^3}$ ✓ ①

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

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

$y = \dfrac{8 \times 5}{\sqrt{x^3}} = \dfrac{40}{\sqrt{x^3}}$ ✓ ①

(Total for Question 17 is 4 marks)

18

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

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

✓①

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

$\dfrac{3 \times 14}{7 \times 3} \times 8$ ✓①

3's cancel   left with 2×8
7's cancel $= 16$

16   ✓①

(Total for Question 18 is 4 marks)

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

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

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

cross multiply ✓①

$\dfrac{1(x-1) + 3(2x-1)}{(2x-1)(x-1)} = 1$

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

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

$0 = 2x^2 - 10x + 5$ ✓①

quadratic formula $\quad\quad \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$\dfrac{10 \pm \sqrt{(-10)^2 - (4 \times 2 \times 5)}}{2 \times 2}$ ✓①

roots can only ÷ with roots. Have to do

$\quad\quad \sqrt{60} \div \sqrt{4}$

$\quad\quad\quad\quad = \sqrt{15}$

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

$\dfrac{10 \pm \sqrt{60}}{4} \quad\quad \div 2$

$\dfrac{5 \pm \sqrt{15}}{2}$ ✓①

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

(Total for Question 19 is 4 marks)

20 The centre of a circle is the point with coordinates $(-1, 3)$
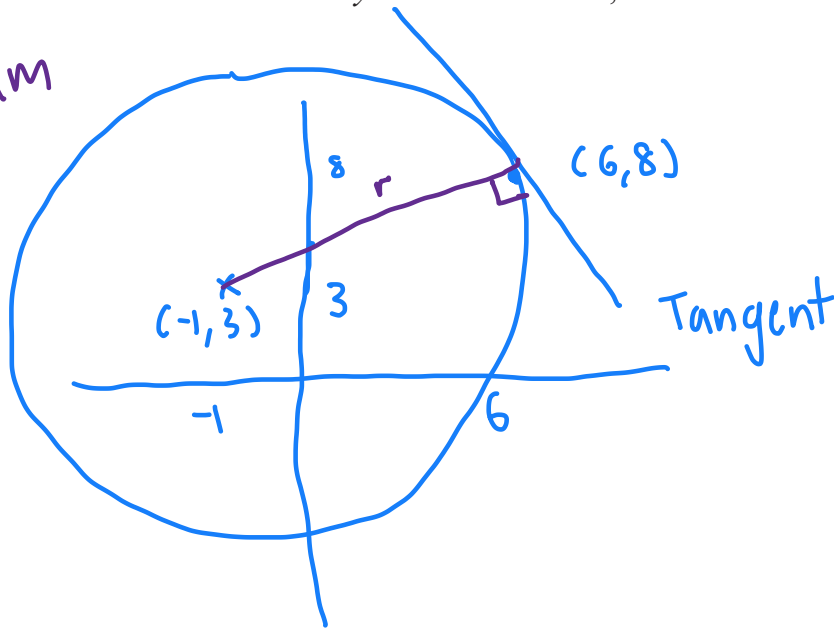
The point A with coordinates $(6, 8)$ lies on the circle.

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

$$M_{radius} \rightarrow \frac{\Delta y}{\Delta x} = \frac{8-3}{6--1} = \frac{5}{7} \checkmark①$$

$$M_{TANGENT} \rightarrow -\frac{7}{5} \checkmark① \text{ (negative reciprocal of radius)}$$

tangent hits $(6, 8)$ $\overset{x_1, y_1}{}$

$$y - y_1 = M(x - x_1)$$

$$y - 8 = -\frac{7}{5}(x-6) \checkmark①$$

$$5y - 40 = -7(x-6)$$

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

$$7x + 5y - 82 = 0 \checkmark①$$

(Total for Question 20 is 4 marks)

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

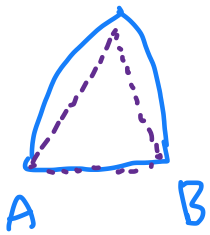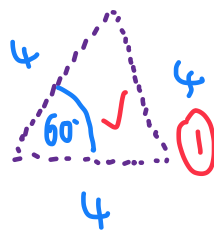The centres of the circles are A, B and C such that ABC is a straight line and $AB = BC = 4$ cm.
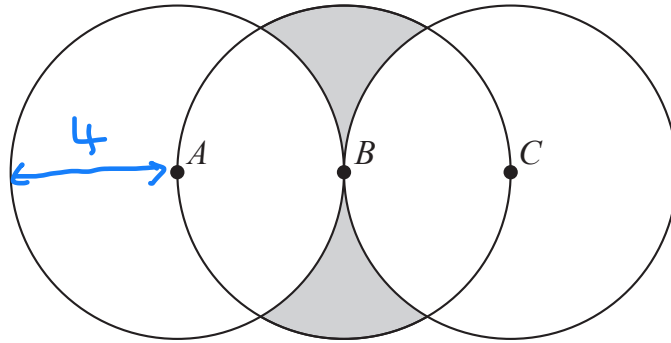
Work out the total area of the two shaded regions.
Give your answer in terms of π

shaded = middle circle
− white areas

white areas => $4 \times \cap$
       A   B

$\cap$ split into $\triangle$ 60°   and $2 \times$ segment
A   B

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

one segment $= 4^2 \pi \times \dfrac{60}{360} - \dfrac{1}{2} \times 4 \times 4 \times \sin 60$

       one △ ✓①

one white area => $4\sqrt{3} + 2\left(\dfrac{16\pi}{6} - 4\sqrt{3}\right)$ 2 segments

$\cap = \dfrac{16\pi}{3} - 4\sqrt{3}$ ✓①

Shaded => middle circle $- 4 \cap$ ✓①

$16\pi - 4\left(\dfrac{16\pi}{3} - 4\sqrt{3}\right) = \underline{16\sqrt{3} - \dfrac{16\pi}{3}}$ cm²

(Total for Question 21 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

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