

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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Pearson Edexcel Level 1/Level 2 GCSE (9–1)**Friday 19 May 2023**

Morning (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.

Turn over ►

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Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Work out $8.46 \div 0.15$

convert to whole numbers by $\times 100$ on both sides

$$846 \div 15 \Rightarrow 15 \overline{) 846.0}$$

$$\begin{array}{r} 56.4 \\ 15 \overline{) 846.0} \\ \underline{75} \\ 96 \\ \underline{90} \\ 60 \\ \underline{60} \\ 0 \end{array}$$

✓ ①
56.4

(Total for Question 1 is 3 marks)

2 Work out $7\frac{3}{8} - 2\frac{1}{2}$

Give your answer as a mixed number.

convert to improper fractions

$$\frac{59}{8} - \frac{5}{2} \quad \checkmark \text{①}$$

change to have same denominators

$$\frac{59}{8} - \frac{20}{8} = \frac{39}{8} \quad \checkmark \text{①}$$

back to mixed number

8
16
24
32
40

$$4\frac{7}{8}$$

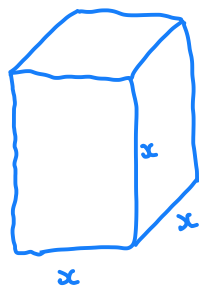
✓ ①
4 $\frac{7}{8}$

(Total for Question 2 is 3 marks)

- 3 A cube has a total surface area of 150 cm^2

Work out the volume of the cube.

diagram



$$\text{Surface area} = 150$$

$$6 \times \text{area of one face} = 150$$

$$\text{area of one face} = 25 \quad \checkmark (1)$$

$$x^2 = 25 \quad \text{so } x = \sqrt{25} = 5 \quad \checkmark (1)$$

$$\text{length 'x'} = 5 \text{ cm}$$

$$\begin{aligned} \text{volume of cube} &= \text{length}^3 \\ &= 5^3 = 125 \quad \checkmark (1) \end{aligned}$$

$$\underline{125} \quad \checkmark (1) \quad \text{cm}^3$$

(Total for Question 3 is 4 marks)

- 4 The table shows information about the daily rainfall in a town for 60 days.

Midpoint

2.5

7.5

12.5

17.5

22.5

Rainfall (R mm)	Frequency
$0 \leq R < 5$	8
$5 \leq R < 10$	24
$10 \leq R < 15$	13
$15 \leq R < 20$	11
$20 \leq R < 25$	4

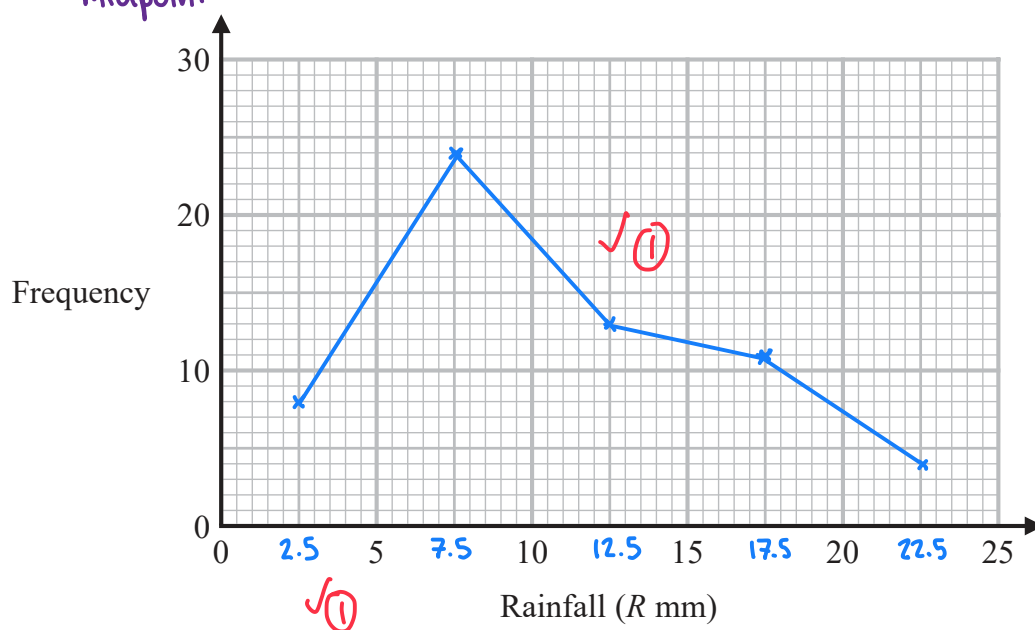
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Draw a frequency polygon for this information.

midpoint



(Total for Question 4 is 2 marks)

5 $\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

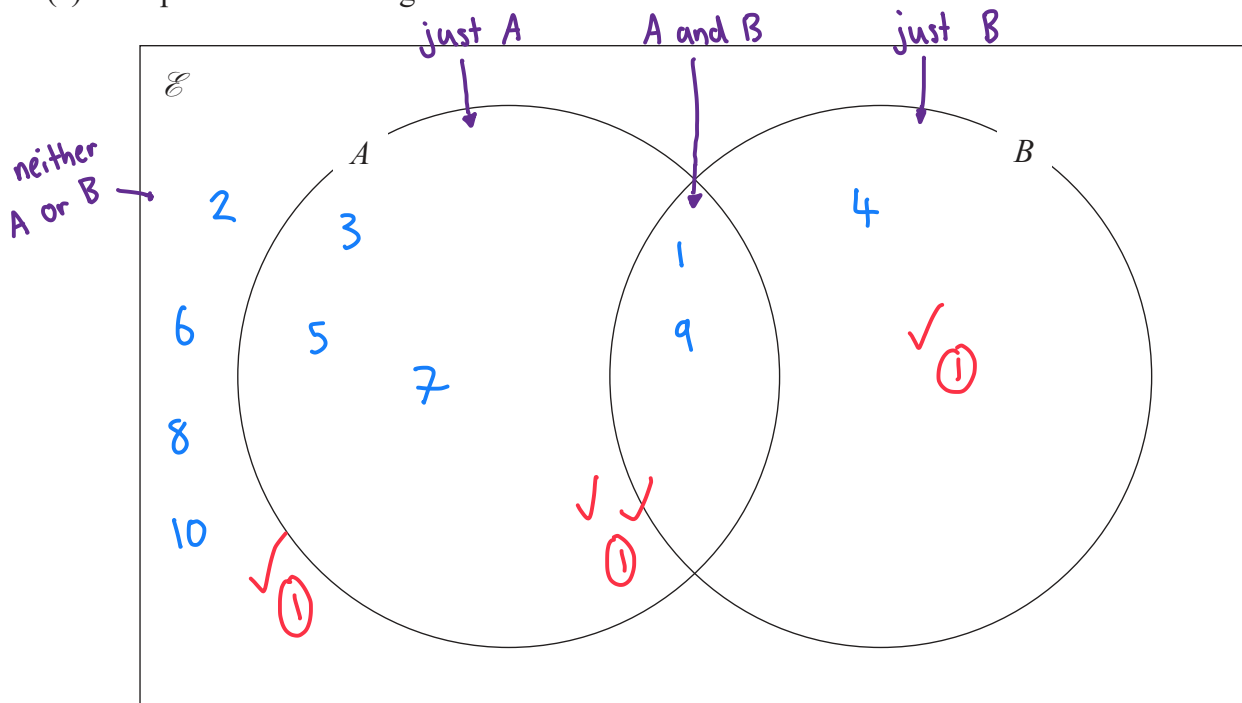
$A = \{\text{odd numbers}\}$

$B = \{\text{square numbers}\}$

List out A and B
between 1-10

$\begin{pmatrix} 1 \\ 3 \\ 5 \\ 7 \\ 9 \end{pmatrix}$ $\begin{pmatrix} 4 \\ 9 \end{pmatrix}$

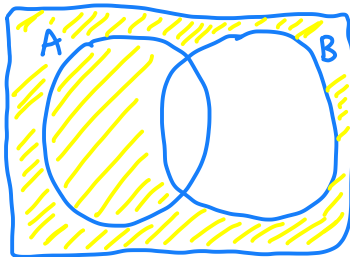
(a) Complete the Venn diagram for this information.



(3)

A number is chosen at random from the universal set $\mathcal{E}$

(b) Find the probability that this number is in the set B' B' means not B



$B' = \text{shaded}$

7 numbers not in B

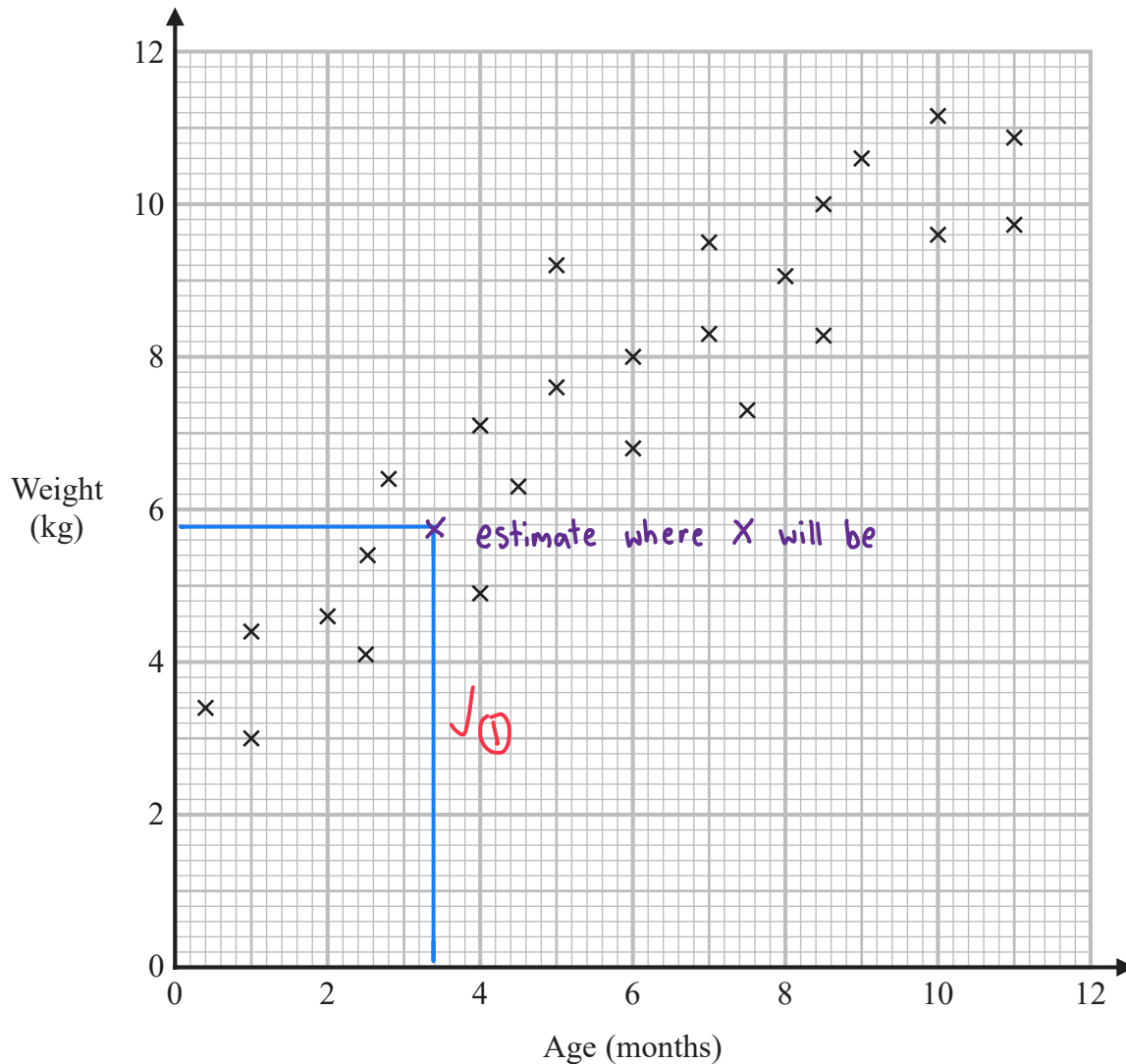
10 total numbers

$\frac{7}{10}$

(2)

(Total for Question 5 is 5 marks)

- 6 The scatter graph shows information about the ages and weights of some babies.



- (a) Describe the relationship between the age and the weight of the babies.

positive correlation : as age increases , so does weight ✓ ①

(1)

Another baby has a weight of 5.8 kg

- (b) Using the scatter graph, find an estimate for the age of this baby.

draw lines at 5.8 kg

3.4 ✓ ① months
(2)

(Total for Question 6 is 3 marks)

- 7 The price of a holiday increases by 20%
This 20% increase adds £240 to the price of the holiday.

Work out the price of the holiday before the increase.

let p = price of holiday

price increases by 20% = price increases by £240

$$\begin{array}{rcl} 1.2p & = & p + 240 \\ -p & & -p \end{array}$$

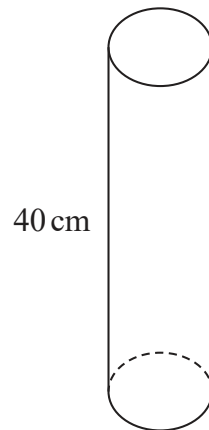
$$0.2p = 240 \quad \text{✓(1)}$$

$$p = \frac{240}{0.2} \stackrel{\times 10}{=} \frac{2400}{2} = £1200$$

£ 1200 ✓(1)

(Total for Question 7 is 2 marks)

- 8 The diagram shows a solid cylinder on a horizontal floor.



$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

The cylinder has a

volume of 1200 cm^3
height of 40 cm.

The cylinder exerts a force of 90 newtons on the floor.

Work out the pressure on the floor due to the cylinder.

already know the force, just need area



$$\text{volume} = 1200$$

$$\text{cross sectional area} \times \text{height} = 1200$$

$$\text{area } \pi r^2 \times 40 = 1200$$

$$\text{area } \pi r^2 = 30 \text{ cm}^2 \quad \checkmark (1)$$

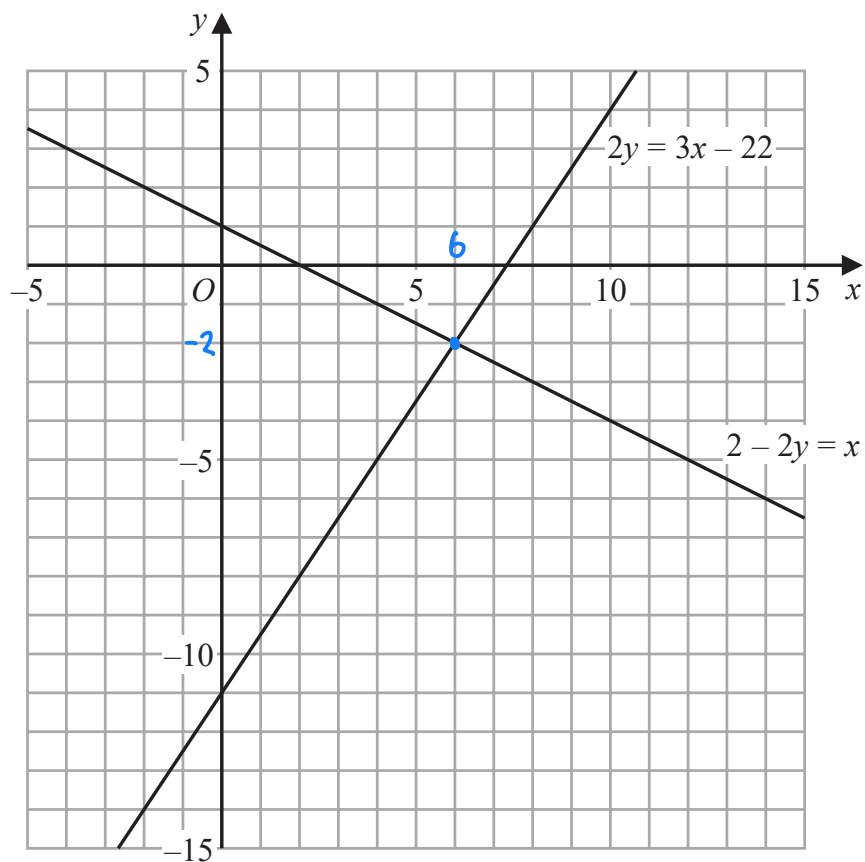
$$\text{Pressure} = \frac{\text{Force}}{\text{Area}} = \frac{90 \text{ N}}{30 \text{ cm}^2} \checkmark (1) = 3 \text{ N/cm}^2$$

3 $\checkmark (1)$

..... newtons/cm²

(Total for Question 8 is 3 marks)

9



Use these graphs to **solve the simultaneous equations** where lines meet

$$\begin{aligned} 2 - 2y &= x \\ 2y &= 3x - 22 \end{aligned}$$

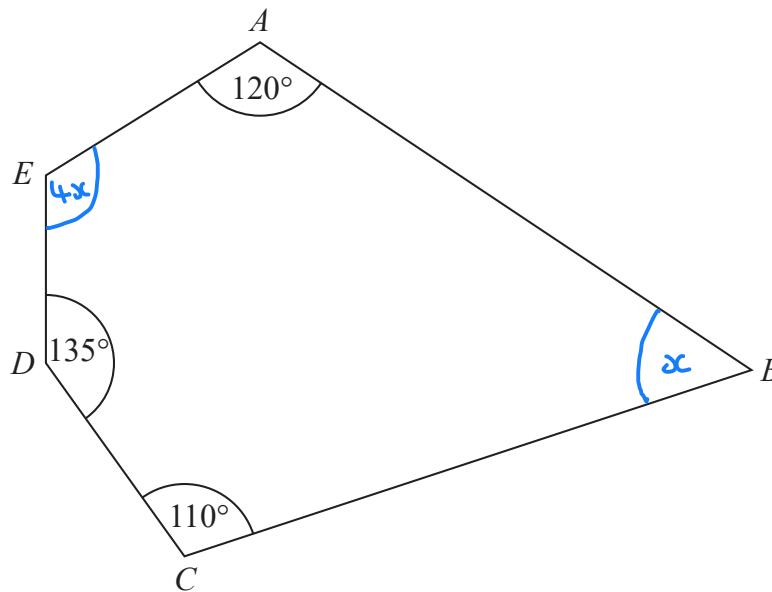
6 across
2 down

$$\begin{aligned} x &= 6 \\ y &= -2 \end{aligned}$$

✓ ①

(Total for Question 9 is 1 mark)

10 Here is a pentagon.



$$\text{Angle } AED = 4 \times \text{angle } ABC$$

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

$$\text{let angle } ABC = x$$

$$\begin{aligned} \text{angle } AED &= 4 \times x \\ &= 4x \end{aligned}$$

$$\text{Sum of interior angles in a pentagon} = (5-2) \times 180^\circ = 540^\circ \quad \checkmark (1)$$

$$120^\circ + 4x^\circ + 135^\circ + 110^\circ + x^\circ = 540^\circ \quad \checkmark (1)$$

collect like terms

$$\begin{array}{r} 365^\circ + 5x^\circ = 540 \\ -365^\circ \quad -365^\circ \\ \hline 5x = 175^\circ \\ \div 5 \quad \div 5 \end{array}$$

$$x = 35^\circ \quad \checkmark (1) \quad \text{so angle } AED = 4 \times 35$$

$$140^\circ$$

$$\checkmark (1) \quad 140$$

(Total for Question 10 is 4 marks)

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- 11 Write $\frac{(6x^5y^3)^2}{3x^2y^7 \times 4xy^{-3}}$ in the form ax^by^c where a , b and c are integers.

Simplify :

$$\frac{6^2 x^{5 \times 2} y^{3 \times 2}}{12 x^{2+1} y^{7+(-3)}} = \frac{36 x^{10} y^6}{12 x^3 y^4}$$

Subtract powers

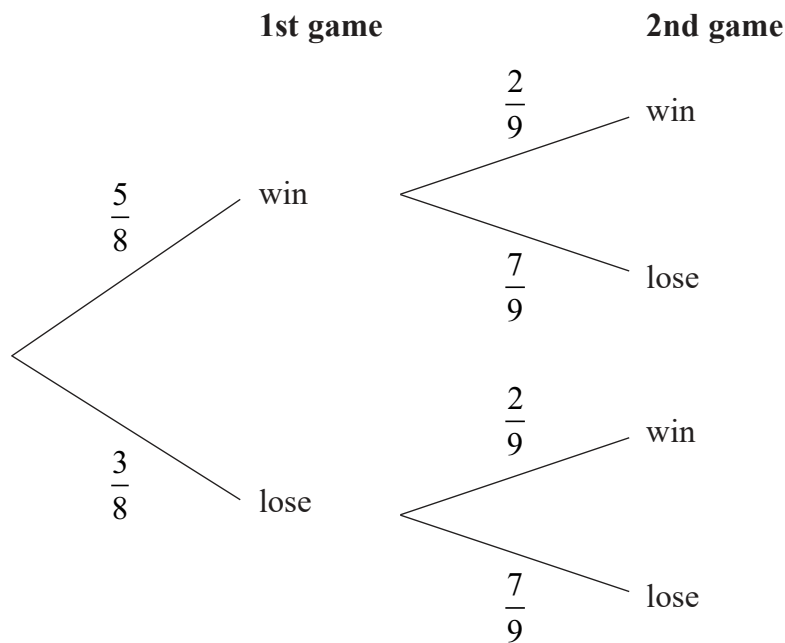
$$3 x^7 y^2$$

$$3 x^7 y^2$$

(Total for Question 11 is 3 marks)

12 Martha plays a game twice.

The probability tree diagram shows the probabilities that Martha will win or lose each game.



Find the probability that Martha will **lose at least one game**.

lose at least one : win $\times$ lose $\frac{5}{8} \times \frac{7}{9} = \frac{35}{72}$ ✓①

lose $\times$ win $\frac{3}{8} \times \frac{2}{9} = \frac{6}{72}$ +

lose $\times$ lose $\frac{3}{8} \times \frac{7}{9} = \frac{21}{72}$ ✓✓①

$\frac{62}{72}$ ✓①

$62/72$

(Total for Question 12 is 3 marks)

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13 y is directly proportional to x .

$$y = 24 \text{ when } x = 1.5$$

Work out the value of y when $x = 5$

$$y = kx$$

$$24 = k \times 1.5$$

$$\div 1.5 \quad \div 1.5$$

$$16 = k$$

$$\rightarrow y = 16x$$

$$\text{when } x = 5, \quad y = 16 \times 5 = 80$$

$$y = 80$$

(Total for Question 13 is 3 marks)

14 (a) Write $\frac{1}{16}$ in the form 4^n where n is an integer.

$$\frac{1}{16}$$

$$= \frac{1}{4^2}$$

fraction means
negative power

$$4^{-2}$$

$$4^{-2}$$

(1)

(b) Work out the value of $8^{\frac{5}{3}} - 9^{\frac{3}{2}}$

$$\text{find values} \Rightarrow (\sqrt[3]{8})^5 - (\sqrt{9})^3$$

$$2^5 - 3^3$$

$$32 - 27 = 5$$

$$5$$

$$5$$

(3)

(Total for Question 14 is 4 marks)

- 15 The equation of line L_1 is $y = 2x - 5$
 The equation of line L_2 is $6y + kx - 12 = 0$

L_1 is perpendicular to L_2

Find the value of k .

You must show all your working.

rewrite both lines in $y = mx + c$ form

$$L_1 \Rightarrow y = 2x - 5$$

$$L_2 \Rightarrow \begin{array}{ccc} 6y + kx - 12 = 0 \\ -kx & +12 & -kx + 12 \end{array}$$

$$\begin{array}{ccc} 6y = -kx + 12 \\ \div 6 & & \div 6 \end{array}$$

$$y = -\frac{k}{6}x + 2 \quad \checkmark \textcircled{1}$$

Perpendicular Lines : gradients are negative reciprocals

$$L_1 \text{ gradient} = 2$$

$$L_2 \text{ gradient has to be } -\frac{1}{2}$$

$$-\frac{1}{2} \times 6 = -\frac{k}{6} \times 6 \quad \checkmark \textcircled{1}$$

$$\begin{array}{ccc} -3 = -k \\ 3 = k & & \checkmark \textcircled{1} \end{array}$$

$$k = 3$$

(Total for Question 15 is 3 marks)

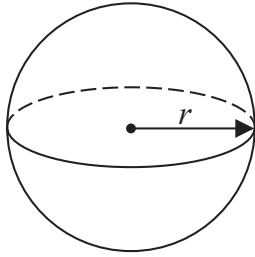
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16 Here is a sphere.



$$\text{Surface area of sphere} = 4\pi r^2$$

$\frac{3}{8}$ of the surface area of this sphere is $75\pi\text{cm}^2$

Find the diameter of the sphere.

Give your answer in the form $a\sqrt{b}$ where a is an integer and b is a prime number.

$$\frac{3}{8} \text{ of surface area} = 75\pi$$

$\div 3 \qquad \qquad \div 3$

$$\frac{1}{8} \text{ of surface area} = 25\pi$$

$\times 8 \qquad \qquad \times 8$

$$\text{Whole surface area} = 200\pi \quad \checkmark \textcircled{1}$$

$$4\pi r^2 = 200\pi$$

cancel π 's and divide by 4

$$r^2 = 50 \quad \checkmark \textcircled{1} \text{ so } r = \sqrt{50} \quad \checkmark \textcircled{1}$$

$$\text{diameter} = 2r = 2\sqrt{50} \text{ or } 2\sqrt{25 \times 2} = 10\sqrt{2}$$

$$10\sqrt{2} \quad \checkmark \textcircled{1}$$

..... cm

(Total for Question 16 is 4 marks)

17 Make x the subject of the formula $y = \frac{4(2x-7)}{5x+3}$

multiply both sides by the denominator

$$y(5x+3) = 4(2x-7) \quad \checkmark \textcircled{1}$$

$$\text{expand: } \underset{-8x}{5xy} + \underset{-8x}{3y} = \underset{-8x}{8x} - 28$$

$$\underset{-3y}{5xy} - 8x + \underset{-3y}{3y} = -28$$

$$5xy - 8x = -28 - 3y \quad \checkmark \textcircled{1}$$

get x 's
on one side

factor out the x

$$x(5y-8) = -28-3y \quad \checkmark \textcircled{1}$$

divide by $5y-8$

$$x = \frac{-28-3y}{5y-8}$$

$$x = \frac{-28-3y}{5y-8} \quad \checkmark \textcircled{1}$$

(Total for Question 17 is 4 marks)

18 7kg of carrots and 5kg of tomatoes cost a total of 480p

cost of 1 kg of carrots : cost of 1 kg of tomatoes = 5 : 9

Work out the cost of 1 kg of carrots and the cost of 1 kg of tomatoes.

set an equation $\textcircled{1} 7c + 5t = 480$ with weights $\checkmark \textcircled{1}$

set another equation with ratios $c : t$ so $\textcircled{2} 9c = 5t \quad \checkmark \textcircled{1}$
 $5 : 9$

Substitute $\textcircled{1}$ into $\textcircled{2}$

$$7c + 9c = 480$$

$$16c = 480$$

$$c = 30$$

$$\textcircled{1} 7c + 5t = 480$$

$$c = 30$$

$$210 + 5t = 480$$

$$5t = 270$$

$$t = 54 \quad \checkmark$$

carrots 30 p $\checkmark \textcircled{1}$

tomatoes 54 p $\checkmark \textcircled{1}$

(Total for Question 18 is 4 marks)

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- 19 The menu in a restaurant has starters, main courses and desserts.

There are 5 starters.

There are 12 main courses.

There are x desserts.

There are 420 different ways to choose one starter, one main course and one dessert.

Work out the value of x .

$$5 \times 12 \times x = 420$$

$$60x = 420 \quad \checkmark \textcircled{1}$$

$$x = 7$$

$$x = \quad \checkmark \textcircled{1} \quad 7$$

(Total for Question 19 is 2 marks)

20 For $x \geq 0$, the functions f and g are such that

$$f(x) = 3x + 4 \quad g(x) = \frac{\sqrt{x} + 2}{5}$$

(a) Find $g^{-1}(x)$

let $y = g(x)$ $y = \frac{\sqrt{x} + 2}{5}$ $\checkmark$ ①

$\times 5$ $\times 5$ $\times 5$

$5y = \sqrt{x} + 2$

$5y - 2 = \sqrt{x}$

$(5y - 2)^2 = x$

change y to x and x to $g^{-1}(x)$

solve for x

$$(5x - 2)^2 = g^{-1}(x)$$

$$g^{-1}(x) = \frac{(5x - 2)^2}{(2)} \checkmark$$

(b) Solve $gf(x) = 3$

use $g(x) = \frac{\sqrt{x} + 2}{5}$ but substitute $x = 3x + 4$

$$\frac{\sqrt{3x+4} + 2}{5} = 3 \checkmark$$

$\times 5$ $\times 5$

$$\sqrt{3x+4} + 2 = 15$$

-2 -2

$$\sqrt{3x+4} = 13$$

$$3x + 4 = 169 \checkmark$$

-4 -4

$$3x = 165 \text{ so } x = 55$$

$\div 3$ $\div 3$

$$x = 55 \checkmark$$

(3)

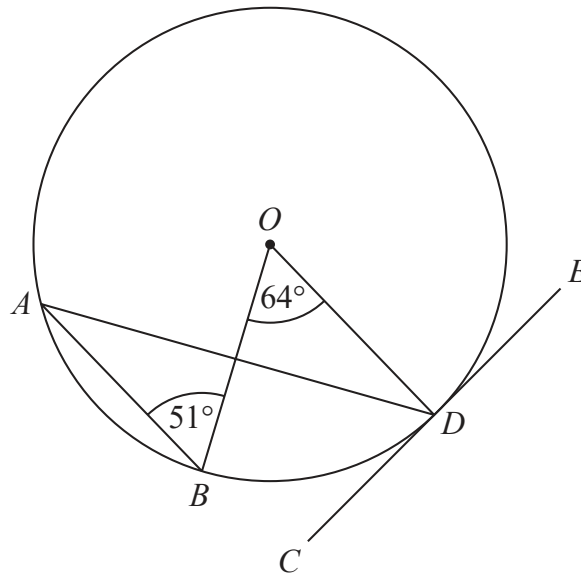
(Total for Question 20 is 5 marks)

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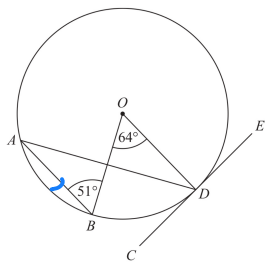
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- 21 A, B and D are points on a circle with centre O .
 CDE is the tangent to the circle at D .



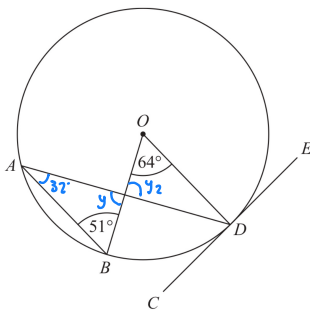
Work out the size of angle ADC .
 Write down any circle theorems you use.



$$\text{angle } BAD = \frac{1}{2} \text{ angle } BOD$$

because angle at circumference is half the angle at centre ✓ ①

$$\text{angle } BAD = 32^\circ \quad \checkmark \text{ ①}$$



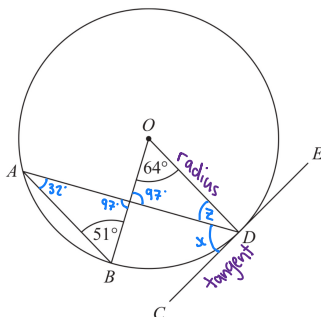
let y = angle inside the triangle

$$y = 180 - 32 - 51 \\ = 97^\circ$$

because angles in a $\triangle$ sum to 180°

$$y_2 = 97^\circ$$

because vertically opposite angles are equal



$$\text{angle } z = 180 - 97 - 64 \\ = 19^\circ \quad \checkmark \text{ ①}$$

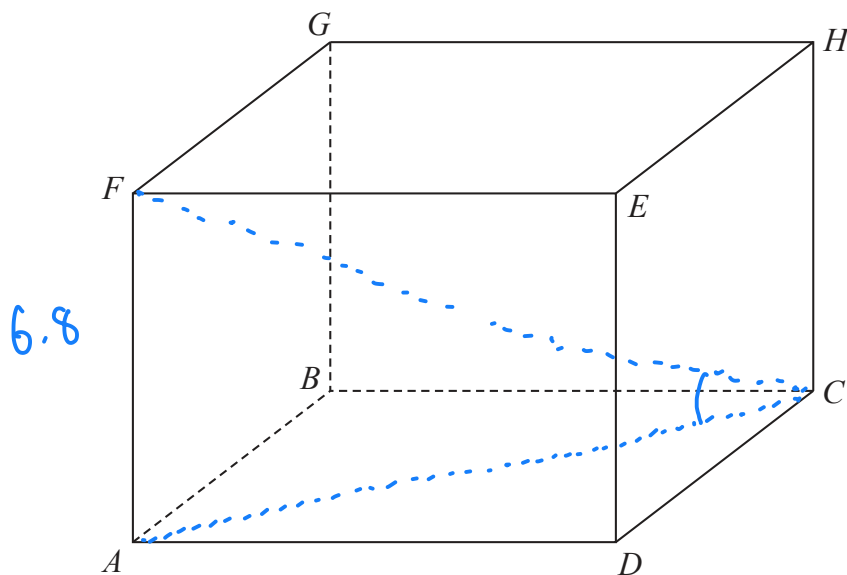
because angles in a $\triangle$ sum to 180°

$$\text{angle } x = 90^\circ - 19^\circ \\ = 71^\circ$$

because a radius (OD) and tangent meeting form 90° 71 ✓ ①

(Total for Question 21 is 4 marks)

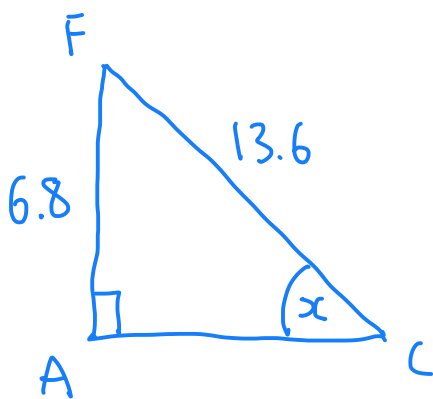
22 $ABCDEFGH$ is a cuboid.



$$AF = 6.8 \text{ cm}$$

$$FC = 13.6 \text{ cm}$$

Work out the size of the angle between FC and the plane $ABCD$.



S^OH

$$\sin x = \frac{6.8}{13.6} \quad (\text{simplifies to } \frac{1}{2})$$

$$x = \sin^{-1} \left(\frac{1}{2} \right) \quad \checkmark \textcircled{1}$$

$$x = 30^\circ$$

$\checkmark \textcircled{1}$
30

(Total for Question 22 is 2 marks)

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23 Write $\frac{3\sqrt{3}}{4-\sqrt{3}} - \frac{2}{\sqrt{3}}$ in the form $\frac{a\sqrt{3}+b}{c}$ where a , b and c are integers.

cross multiply to get the same denominator

$$\frac{3\sqrt{3}(\sqrt{3}) - 2(4-\sqrt{3})}{(4-\sqrt{3})(\sqrt{3})} \text{ expands to } \frac{9-8+2\sqrt{3}}{4\sqrt{3}-3} \quad \checkmark \textcircled{1}$$

$$\frac{1+2\sqrt{3}}{4\sqrt{3}-3} \times \frac{4\sqrt{3}+3}{4\sqrt{3}+3} \quad \text{rationalise}$$

$$\frac{(1+2\sqrt{3})(4\sqrt{3}+3)}{(4\sqrt{3}-3)(4\sqrt{3}+3)} \text{ expands to } \frac{4\sqrt{3}+3+24+6\sqrt{3}}{48-9} \quad \checkmark \textcircled{1}$$

collect like terms: $\frac{10\sqrt{3}+27}{39}$ in $\frac{a\sqrt{3}+b}{c}$ form

$$\frac{10\sqrt{3}+27}{39} \quad \checkmark \textcircled{1}$$

(Total for Question 23 is 4 marks)

24 Find the set of possible values of x for which

$$4x^2 - 25 < 0 \quad \text{and} \quad 12 - 5x - 3x^2 > 0$$

You must show all your working.

$$4x^2 - 25 < 0$$

+25 +25

$$4x^2 < 25$$

÷4 ÷4

$$x^2 < \frac{25}{4} \quad \checkmark \textcircled{1}$$

square root
could be positive or negative (sign change)

$$x < \frac{5}{2} \quad x > -\frac{5}{2}$$

$$\downarrow$$

$$-\frac{5}{2} < x < \frac{5}{2}$$

or

$$-2.5 < x < 2.5 \quad \checkmark \textcircled{1}$$

$$12 - 5x - 3x^2 > 0$$

multiply by -1 and flip sig

$$3x^2 + 5x - 12 < 0$$

numbers that $\times$ to get -36 are +9 and -4
+ to get +5

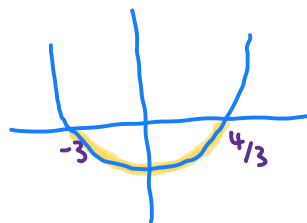
rewrite as $3x^2 + 9x - 4x - 12 < 0$

$$\underline{3x(x+3)} - \underline{4(x+3)} < 0$$

match

$$(x+3)(3x-4) < 0 \quad \checkmark \textcircled{1}$$

graph



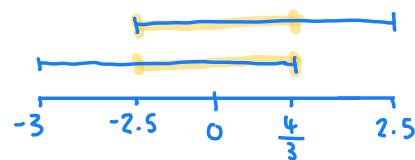
0 is greater so
under the x axis

$$-3 < x < \frac{4}{3} \quad \checkmark \textcircled{1}$$

To fit both inequalities

$$-2.5 < x < 2.5$$

$$-3 < x < \frac{4}{3}$$



shaded: $-2.5 < x < \frac{4}{3} \quad \checkmark$

$$\checkmark \textcircled{1}$$

$$-2.5 < x < \frac{4}{3}$$

(Total for Question 24 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

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