

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Work out $4.62 \div 0.12$

$$\frac{4.62}{0.12} \times 100 = \frac{462}{12}$$

$$12 \overline{) 4462.0} \\ \underline{0} \quad \underline{38} \quad \underline{5} \\ 4462.0$$

12
24
36
48
60
72
84
96
108
120

38.5

.....
(Total for Question 1 is 3 marks)

2 Work out $5\frac{3}{10} - 3\frac{2}{5}$

Give your answer as a mixed number.

$$5\frac{3}{10} = \frac{53}{10}$$

$$3\frac{2}{5} = \frac{17}{5}$$

$$= \frac{53}{10} - \frac{17}{5}$$

$$= \frac{53}{10} - \frac{34}{10}$$

$$= \frac{19}{10}$$

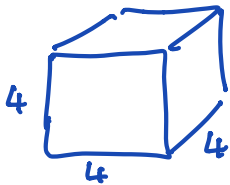
$$\frac{19}{10} = 1\frac{9}{10}$$

$$1\frac{9}{10}$$

(Total for Question 2 is 3 marks)

3 A cube has a total volume of 64 cm^3

Work out the surface of the cube.



$$4 \times 4 \times 4 = 64 \text{ cm}^3$$

$$\text{area of 1 face} = 4 \times 4 = 16 \text{ cm}^2$$

$$\text{so 6 faces} = 16 \times 6$$

$$= 96$$

$$\begin{array}{r} 16 \\ \times 6 \\ \hline 96 \\ 3 \end{array}$$

$$96$$

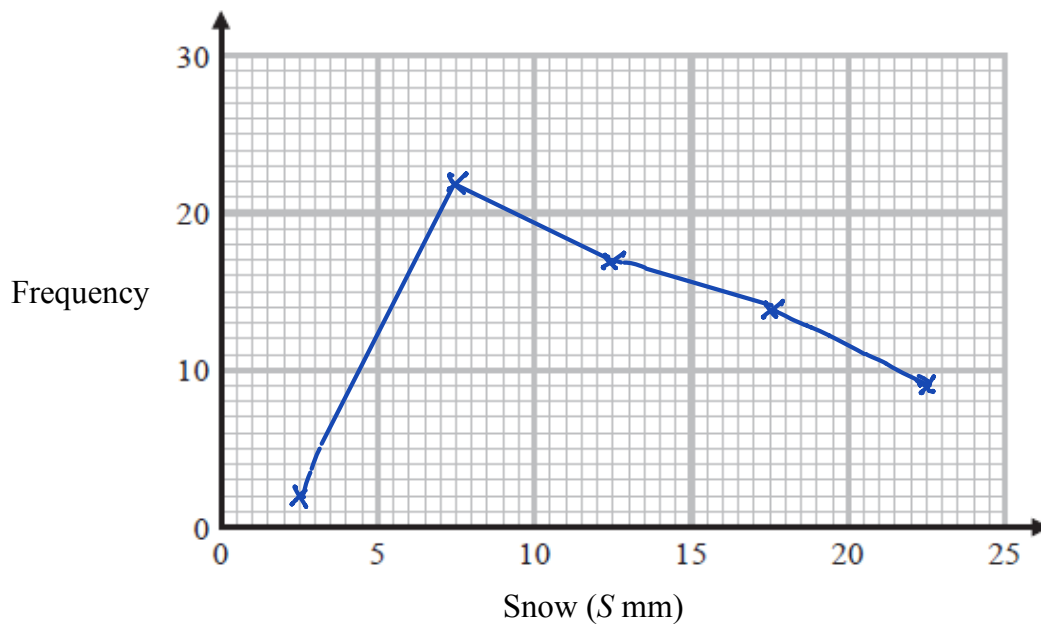
..... cm^2

(Total for Question 3 is 4 marks)

- 4 The table shows information about the amount of snow, in mm, in a town for 70 days in winter.

Snow (S mm)	Frequency
$0 \leq S < 5$	2
$5 \leq S < 10$	22
$10 \leq S < 15$	17
$15 \leq S < 20$	14
$20 \leq S < 25$	9

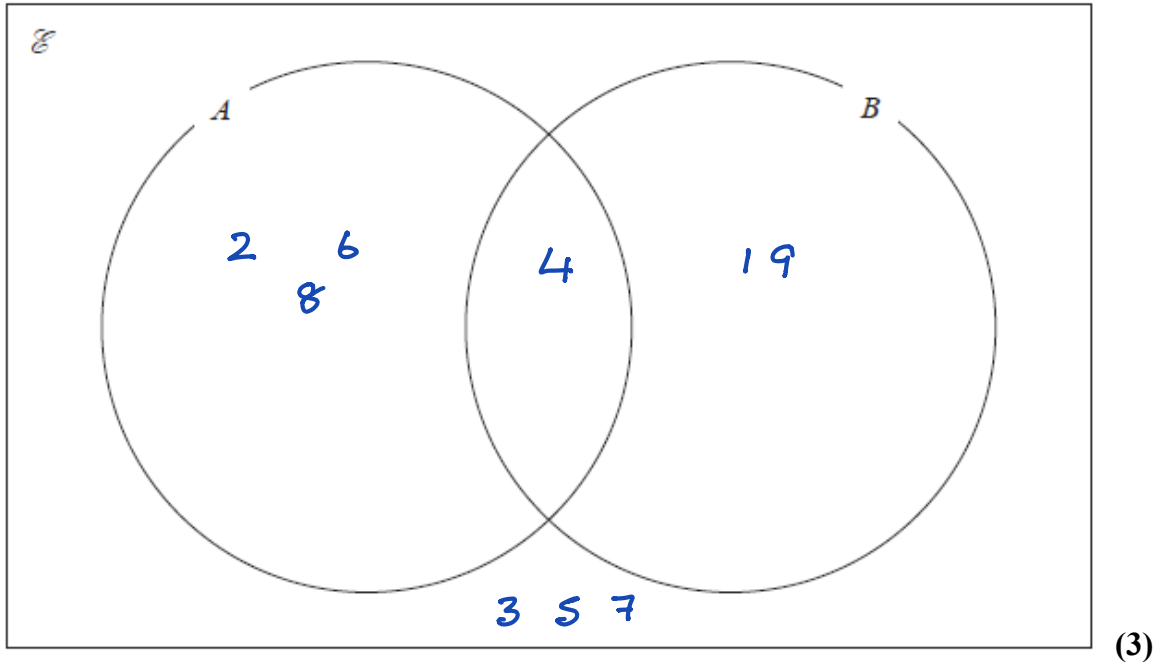
Draw a frequency polygon for this information.



(Total for Question 4 is 2 marks)

- 5 $\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
 $A = \{\text{even numbers}\}$ 2 4 6 8
 $B = \{\text{square numbers}\}$ 1 4 9

(a) Complete the Venn diagram for this information.



A number is chosen at random from the universal set \mathcal{E} $\frac{10}{10}$

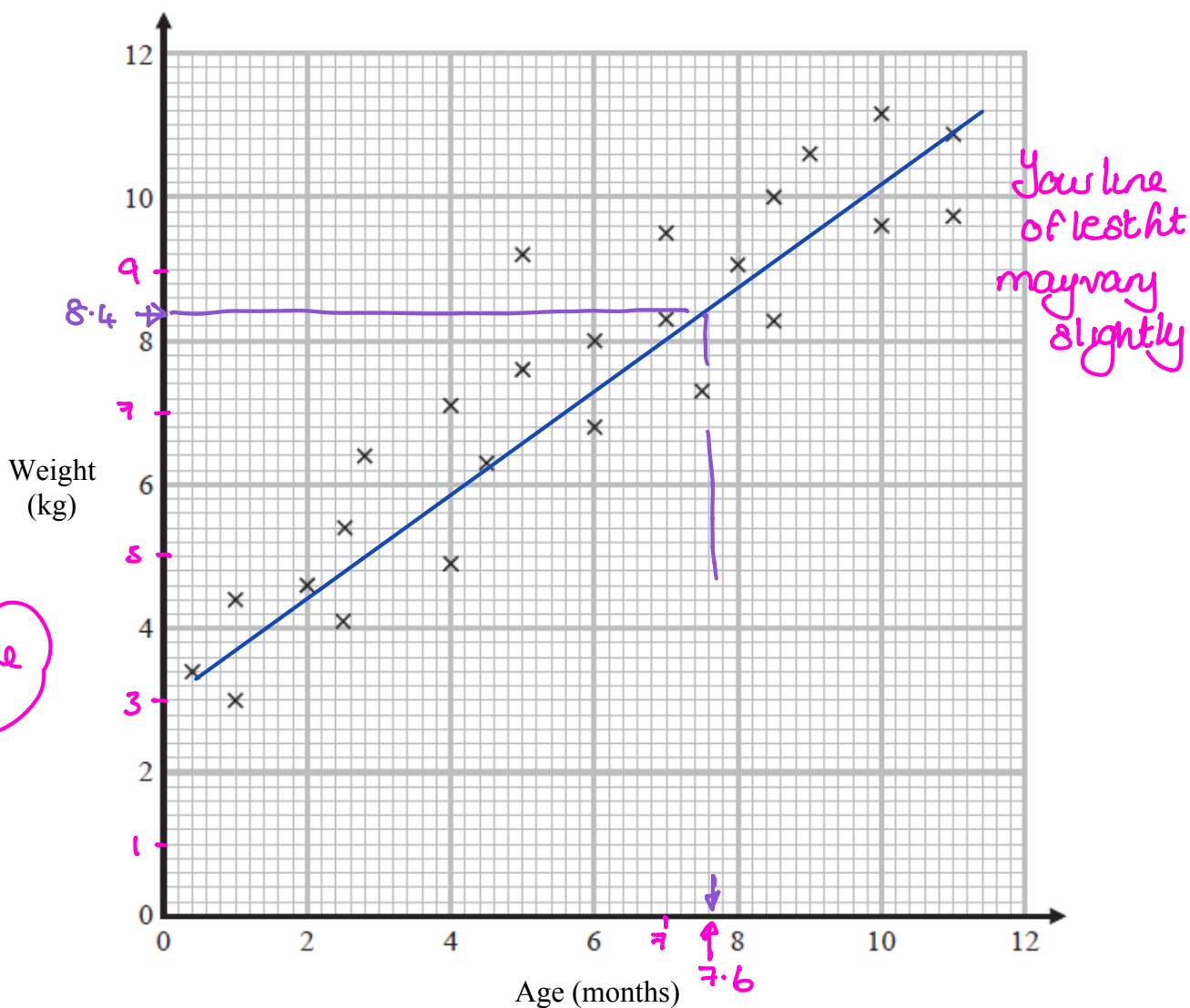
- (b) Find the probability that this number is in the set A'
 NOT A

$$\frac{5}{10}$$

(2)

(Total for Question 5 is 5 marks)

6 The scatter graph shows information about the ages and weights of some newborn monkeys.



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

Positive correlation, i.e. the older the baby monkey the heavier they are in general.

(1)

Another monkey has a weight of 8.4 kg

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

..... 7.6 months

(2)

(This may vary so a range from 7-9 is accepted)

(Total for Question 6 is 3 marks)

- 7 The price of a console increases by 15%
This 15% increase adds £375 to the price of the console.

Work out the price of the console before the increase.



$$\begin{array}{l}
 15\% = 375 \\
 \div 3 \quad \downarrow \quad \quad \quad \downarrow \quad \div 3 \\
 5\% = 125 \\
 \times 2 \quad \downarrow \quad \quad \quad \downarrow \quad \times 2 \\
 10\% = 250 \\
 \times 10 \quad \downarrow \quad \quad \quad \downarrow \quad \times 10 \\
 100\% = 2500
 \end{array}$$

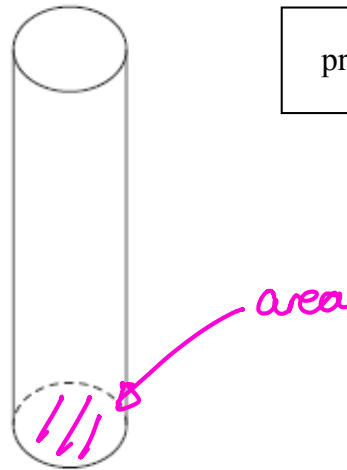
£ 2500

(Total for Question 7 is 2 marks)

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

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

Volume : area x length 50 cm
1500 = area x 50
so: area = $\frac{1500}{50} = 30 \text{ cm}^2$



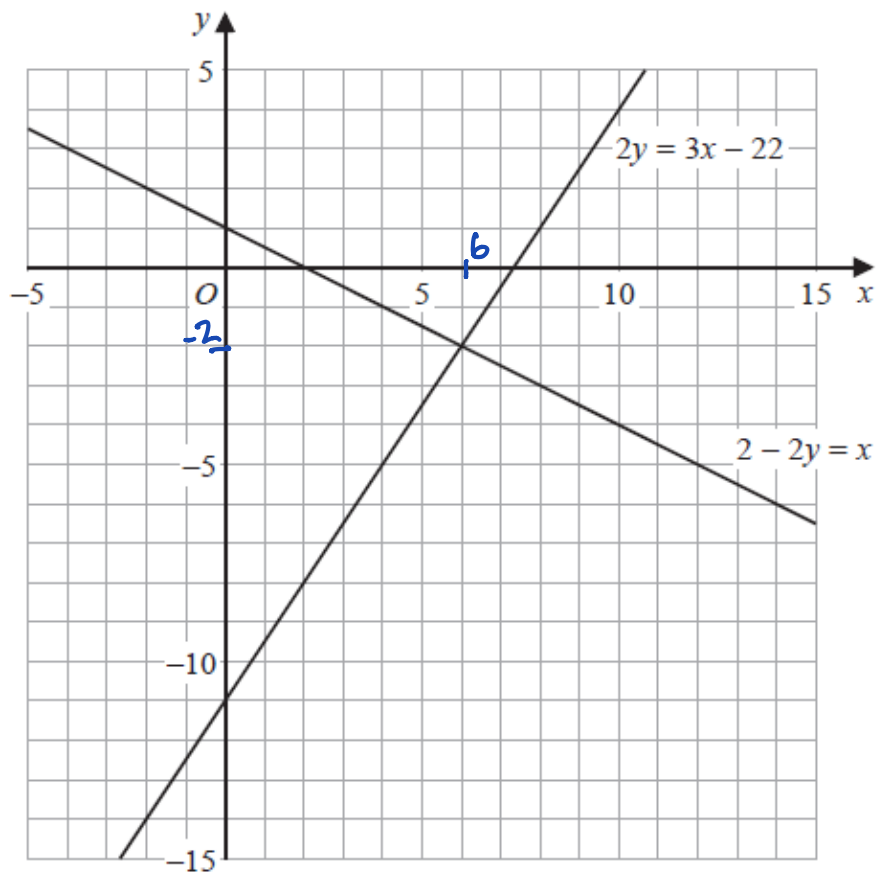
The cylinder has a

volume of 1500 cm³
height of 50 cm.

The cylinder exerts a force of 120 newtons on the floor.
Work out the pressure on the floor due to the cylinder.

$$\begin{aligned} \text{Pressure} &= \frac{120}{30} \\ &= 4 \end{aligned}$$

..... 4 newtons/cm²
(Total for Question 8 is 3 marks)



Use these graphs to solve the simultaneous equations

$$2y = 3x - 22$$

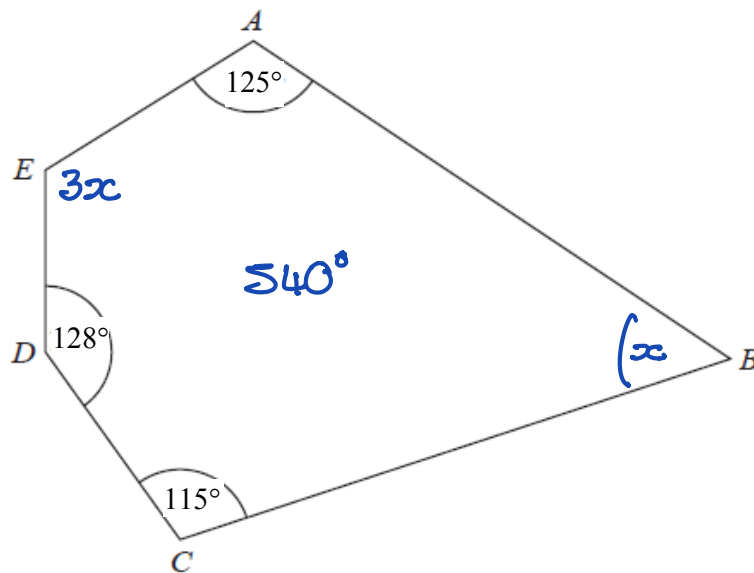
$$2 - 2y = x$$

$$x = \dots\dots\dots 6 \dots\dots\dots$$

$$y = \dots\dots\dots -2 \dots\dots\dots$$

(Total for Question 9 is 1 mark)

10 Here is a pentagon.



Angle $AED = 3 \times$ angle ABC ✓

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

3 sides = 180
4 sides = 360
5 sides = 540

$$\begin{aligned} 540 &- (125 + 115 + 128) \\ &= 540 - 368 \\ &= 172 \end{aligned}$$

$$\begin{aligned} 4x &= 172 \\ x &= \frac{172}{4} \\ &= 43 \end{aligned}$$

43

(Total for Question 10 is 4 marks)

- 11 Write $\frac{(10x^6y^4)^2}{4x^2y^5 \times 5xy^{-4}}$ in the form ax^by^c where a , b and c are integers.

$$\frac{10^2 x^{6 \times 2} y^{4 \times 2}}{20 x^{2+1} y^{5-4}}$$

$$= \frac{100 x^{12} y^8}{20 x^3 y^1}$$

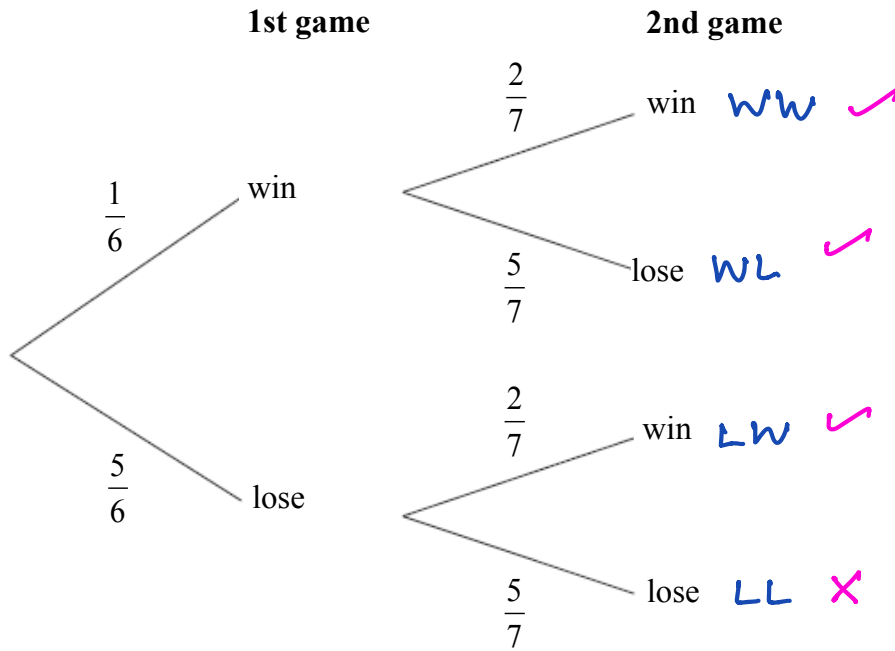
$$10 \div 20 = 5 \quad 5 x^{12-3} y^{8-1}$$
$$= 5x^9 y^7$$

$$5x^9 y^7$$

(Total for Question 11 is 3 marks)

12 Malcolm plays two games of tennis.

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



Find the probability that Malcolm will win at least one game.

$$\frac{1}{6} \times \frac{2}{7} + \frac{1}{6} \times \frac{5}{7} + \frac{5}{6} \times \frac{2}{7}$$

$$= \frac{2}{42} + \frac{5}{42} + \frac{10}{42}$$

$$= \frac{17}{42}$$

$$\frac{17}{42}$$

(Total for Question 12 is 3 marks)

13 y is directly proportional to x .

$$y = 36 \text{ when } x = 1.2$$

Work out the value of y when $x = 4$

$$y \propto x$$
$$y = kx$$

$$\text{so } y = 30x$$
$$\text{when } x = 4 \quad y = 30 \times 4$$
$$= 120$$

$$36 = k \times 1.2$$

$$k = \frac{36}{1.2} = \frac{360}{12}$$
$$= 30$$

$$y = \dots\dots\dots 120 \dots\dots\dots$$

(Total for Question 13 is 3 marks)

14 (a) Write $\frac{1}{81}$ in the form 3^n where n is an integer.

$$81 = 3^4$$

$$\frac{1}{81} = \frac{1}{3^4} = 3^{-4}$$

$$\dots\dots\dots 3^{-4} \dots\dots\dots$$

(1)

(b) Work out the value of $27^{\frac{4}{3}} - 16^{\frac{3}{2}}$

$$(3\sqrt[3]{27})^4 = 3^4 = 81$$

$$(2\sqrt{16})^3 = 4^3 = 64$$

$$81 - 64 = 17$$

$$\dots\dots\dots 17 \dots\dots\dots$$

(3)

(Total for Question 14 is 4 marks)

- 15 The equation of line L_1 is $y = 3x - 5$
The equation of line L_2 is $4y + kx - 20 = 0$

L_1 is perpendicular to L_2

Find the value of k .

You must show all your working.

$$L_1 \quad y = 3x - 5$$

$$L_2 \text{ gradient} = -\frac{1}{3}$$

$$L_2 \quad 4y = -kx + 20$$

$$y = -\frac{k}{4}x + 5$$

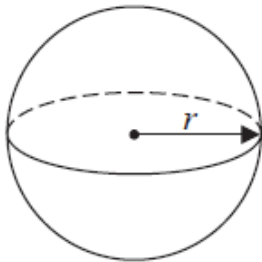
$$\text{so } -\frac{k}{4} = -\frac{1}{3}$$

$$k = \frac{4}{3}$$

$$k = \frac{4}{3} \text{ OR } \frac{1}{3}$$

(Total for Question 15 is 3 marks)

16 Here is a sphere.



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

$\frac{5}{8}$ of the surface area of this sphere is $375\pi \text{ cm}^2$

Find the diameter of the sphere.

Give your answer in the form $a\sqrt{b}$ where both a and b are integers.

$$\text{if } \frac{5}{8} = 375\pi$$

$$\frac{1}{8} = \frac{375\pi}{5}$$

$$= 75\pi$$

$$5 \overline{) 375} \begin{matrix} 075 \\ \underline{375} \end{matrix}$$

so the whole surface area = $75\pi \times 8$
 $= 600\pi$

$$600\pi = 4\pi r^2$$

$$r = \sqrt{150}$$

$$= \sqrt{25\sqrt{6}}$$

$$= 5\sqrt{6}$$

..... $5\sqrt{6}$ cm

(Total for Question 16 is 4 marks)

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

$$y(7x+4) = 15x - 10$$

$$7xy + 4y = 15x - 10$$

$$4y + 10 = 15x - 7xy$$

$$x(15 - 7y) = 4y + 10$$

$$x = \frac{4y + 10}{15 - 7y}$$

$$x = \frac{4y + 10}{15 - 7y}$$

(Total for Question 17 is 4 marks)

- 18 8 kg of aubergines and 3 kg of radishes cost a total of £28

cost of 1 kg of aubergines : cost of 1 kg of radishes = 1 : 2

Work out the cost of 1 kg of aubergines and the cost of 1 kg of radishes.

$$8A + 3R = 28$$

$$A : R = 1 : 2 \quad \frac{A}{R} = \frac{1}{2} \quad \text{so } R = 2A$$

sub into equation

$$8A + 3(2A) = 28$$

$$14A = 28$$

$$A = £2$$

$$R = 2 \times A \\ = £4$$

aubergines £.....2.....

radishes £.....4.....

(Total for Question 18 is 4 marks)

19 A tailor's shop sells jackets, shirts and pairs of shoes.

The shop sells 7 varieties of jackets.

The shop sells x varieties of shirt.

The shop sells 3 varieties of pairs shoes.

$$21 \overline{) 2^2 3^2 1} \begin{array}{r} 011 \\ \hline \end{array}$$

There are 231 different ways to choose one jacket, one shirt and one pair of shoes.

Work out the value of x .

$$7 \times x \times 3 = 231$$

$$x = \frac{231}{21}$$

$$= 11$$

$$x = \dots\dots\dots 11 \dots\dots\dots$$

(Total for Question 19 is 2 marks)

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

$$f(x) = 2x - 6 \qquad g(x) = \frac{2\sqrt{x}}{3} + 7$$

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

$$y = \frac{2\sqrt{x}}{3} + 7$$

$$3(y - 7) = 2\sqrt{x}$$

$$\sqrt{x} = \left[\frac{3(y-7)}{2} \right]^2$$

$$g^{-1}(x) = \left[\frac{3(y-7)}{2} \right]^2 \dots\dots\dots (2)$$

(b) Solve $gf(x) = 15$

$$gf(x) = \frac{2\sqrt{2x-6}}{3} + 7 = 15$$

$$2\sqrt{2x-6} = 8 \times 3$$

$$\sqrt{2x-6} = 12$$

$$2x-6 = 144$$

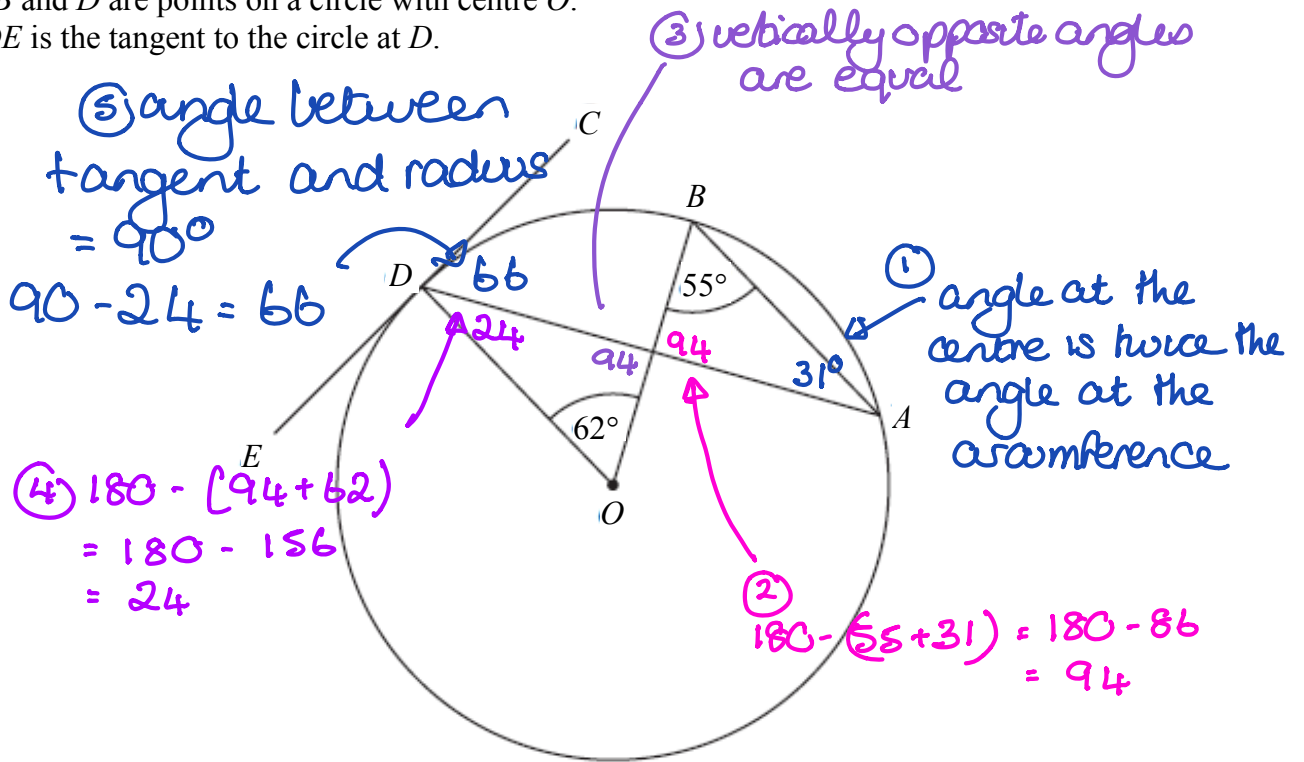
$$2x = 150$$

$$x = 75$$

$$x = \dots\dots\dots 75 \dots\dots\dots (3)$$

(Total for Question 20 is 5 marks)

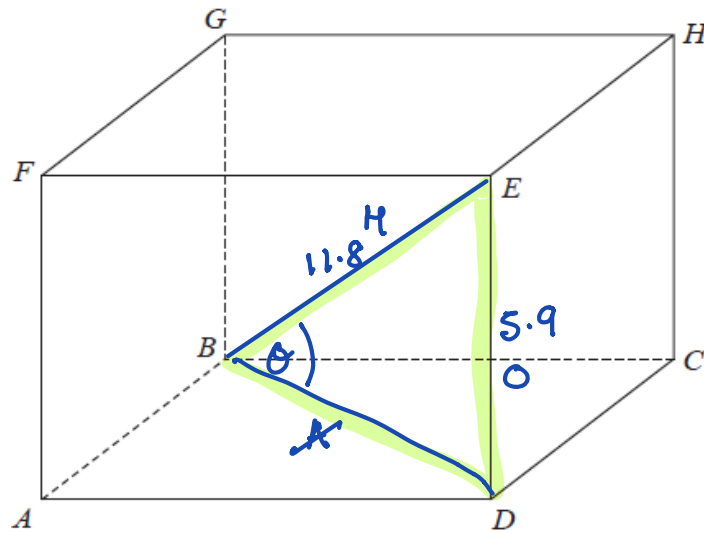
21 A, B and D are points on a circle with centre O .
 CDE is the tangent to the circle at D .



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

..... 66°
 (Total for Question 21 is 4 marks)

22 $ABCDEFGH$ is a cuboid.



$ED = 5.9$ cm
 $BE = 11.8$ cm



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

$$\sin \theta = \frac{5.9}{11.8} = \frac{1}{2}$$

$$\text{if } \sin \theta = \frac{1}{2} \quad \theta = 30^\circ$$

..... 30

(Total for Question 22 is 2 marks)

23 Write $\frac{3\sqrt{5}}{4-\sqrt{5}} - \frac{2}{\sqrt{5}}$ in the form $\frac{a\sqrt{5}+b}{c}$ where a, b and c are integers.

$$\frac{3\sqrt{5} \times (4 + \sqrt{5})}{(4 - \sqrt{5}) \times (4 + \sqrt{5})} = \frac{12\sqrt{5} + 3\sqrt{5}\sqrt{5}}{16 - 5}$$

$$= \frac{12\sqrt{5} + 15}{11}$$

$$\frac{12\sqrt{5} + 15}{11} - \frac{2}{\sqrt{5}}$$

$$= \frac{\sqrt{5}(12\sqrt{5} + 15) - 2 \times 11}{11\sqrt{5}}$$

$$= \frac{12\sqrt{5}\sqrt{5} + 15\sqrt{5} - 22}{11\sqrt{5}} = \frac{38 + 15\sqrt{5}}{11\sqrt{5}}$$

$$= \frac{38\sqrt{5} + 15\sqrt{5}\sqrt{5}}{11\sqrt{5}\sqrt{5}} = \frac{38\sqrt{5} + 75}{55}$$

$$\frac{38\sqrt{5} + 75}{55}$$

(Total for Question 23 is 4 marks)

24 Find the set of possible values of x for which

$$9x^2 - 36 < 0 \quad \text{and} \quad 20 - 7x - 3x^2 > 0$$

You must show all your working.

$$(3x+6)(3x-6) < 0$$

$$-6 \div 3 = -2 \quad 6 \div 3 = 2$$

$$-2 < x < 2$$

$$20 - 7x - 3x^2 > 0$$

$$20 \times 3 = 60$$

$$-12 + 5 = -7$$

$$-3x^2 - 7x + 20 > 0$$

$$-3x(x+4) + 5(x+4) > 0$$

$$(x+4)(5-3x) > 0$$

$$-4$$

$$\frac{5}{3}$$

$$-4 < x < \frac{5}{3}$$

$$-2 < x < \frac{5}{3}$$

(Total for Question 24 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS