

1 Work out $818.4 \div 1.2$

$$\begin{array}{r} 818.4 \\ 1.2 \end{array} \quad \begin{array}{c} \times 10 \\ \curvearrowright \\ = \\ \curvearrowleft \\ \times 10 \end{array} \quad \begin{array}{r} 8184 \\ 12 \end{array}$$

$$\begin{array}{r} 0682 \\ 12 \overline{)8184} \end{array}$$

12
24
36
48
60
72
84
96

682

(Total for Question 1 is 3 marks)



- 2 The table shows the probabilities that a biased dice will land on 3, on 4, on 5 and on 6

Number on dice	1	2	3	4	5	6
Probability	0.15	0.15	0.10	0.30	0.05	0.25

= 1

Karim assumes that the probabilities that the dice will land on 1 and on 2 are the same.

Karim rolls the biased dice 500 times.

- (a) Assuming Karim is right, work out an estimate for the number of times the dice will land on 2

$$\begin{array}{r}
 0.10 \\
 + 0.30 \\
 0.05 \\
 0.25 \\
 \hline
 0.70
 \end{array}$$

$$1 - 0.7 = 0.3$$

$$0.3 \div 2 = 0.15$$

$$0.15 \times 500 =$$

15% of 500

10% = 50

5% = 25

15% = 75

75
(3)

Karim is wrong.

The probability that the dice will land on 2 is greater than the probability that the dice will land on 1

- (b) How does this information affect your answer to part (a)?

My answer will be wrong, the correct answer will be more than 75

(1)

(Total for Question 2 is 4 marks)

3 (a) Work out $3\frac{1}{2} - 1\frac{1}{6}$

Give your answer as a mixed number.

$$\begin{array}{r} \frac{7}{2} - \frac{7}{6} \\ \times 3 \quad \downarrow \\ \frac{21}{6} - \frac{7}{6} = \frac{14}{6} = \frac{7}{3} \end{array}$$

$$2\frac{1}{3}$$

(2)

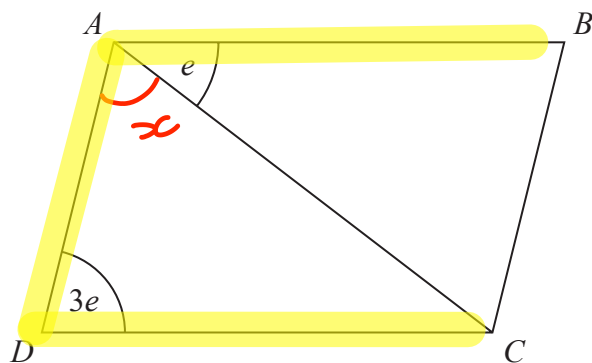
(b) Show that $5\frac{1}{4} \div 2\frac{1}{3} = 2\frac{1}{4}$

$$\begin{array}{l} \frac{21}{4} \div \frac{7}{3} \\ = \frac{21}{4} \times \frac{3}{7} = \frac{63}{28} \xrightarrow{\div 7} \frac{9}{4} = 2\frac{1}{4} \end{array}$$

(3)

(Total for Question 3 is 5 marks)

4 $ABCD$ is a parallelogram.



All angles are measured in degrees.

Find an expression, in terms of e , for the size of angle CAD .
Give a reason for each stage of your working.

Co-interior angles add to 180°

$$e + x + 3e = 180$$

$$x + 4e = 180$$

$$-4e \quad -4e$$

$$x = 180 - 4e$$

$$180 - 4e$$

(Total for Question 4 is 3 marks)



- 5 A car travelled 4.96 miles at an average speed of 30.4 miles per hour.

- (a) Work out an estimate for the time taken by the car.
Give your answer in minutes.



$$T = \frac{D}{S} = \frac{5}{30} = \frac{1}{6} \text{ hours}$$

$$\frac{1}{6} \text{ of } 60 = 10$$

10 minutes
(3)

- (b) Is your answer to part (a) an underestimate or an overestimate?
Give a reason for your answer.

rounded up
rounded down

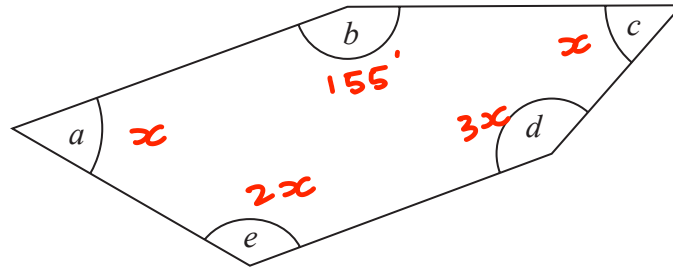
Overestimate, as rounded the distance up and divided by a smaller time

(1)

(Total for Question 5 is 4 marks)



6 Here is a pentagon.



$$\begin{array}{r} 180 \\ \times 3 \\ \hline 540 \\ 2 \end{array}$$

Angle a = angle c

Angle b = 155°

Angle d is three times the size of angle c

Angle e is two times the size of angle c

$$\begin{aligned} (5-2) \times 180 \\ 3 \times 180 &= 540 \end{aligned}$$

Work out the size of angle a

$$x + x + 2x + 3x + 155 = 540$$

$$7x + 155 = 540$$

$$- 155 \quad | \quad - 155$$

$$7x = 385$$

$$\div 7 \quad | \quad \div 7$$

$$x = 55$$

$$\begin{array}{r} 4 \\ 5 \\ 40 \\ - 155 \\ \hline 385 \end{array}$$

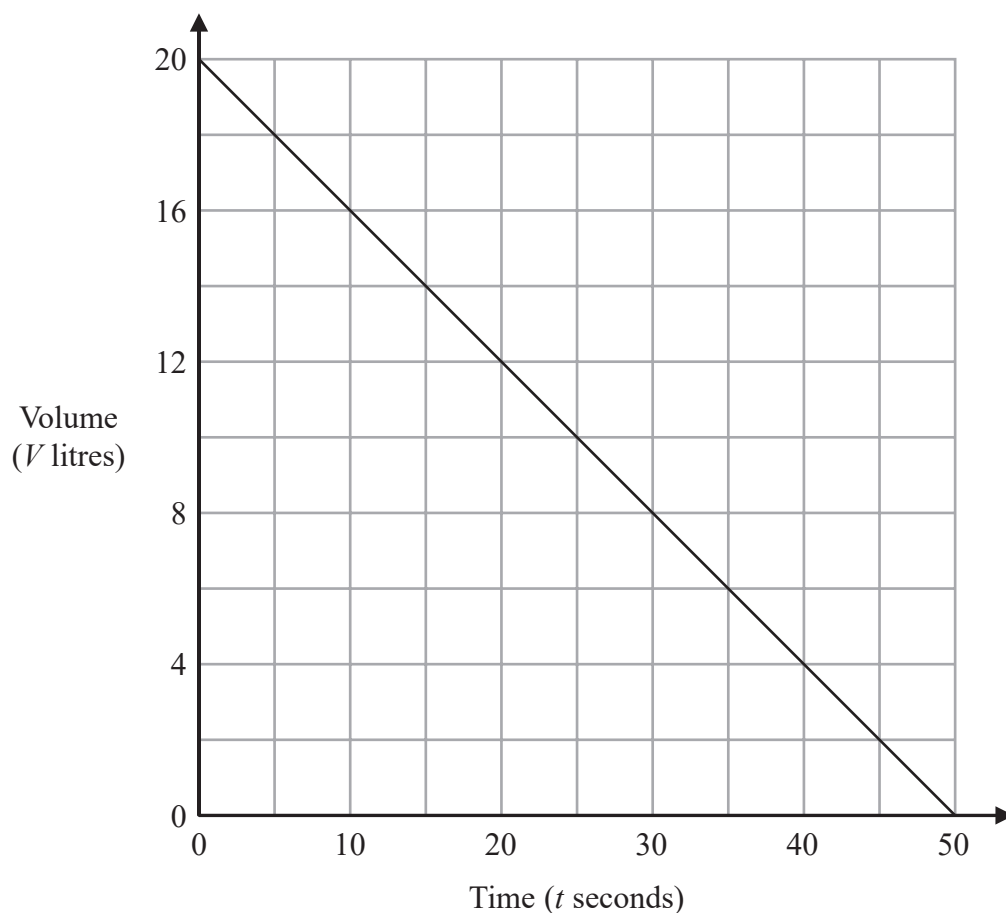
$$\begin{array}{r} 055 \\ 7 \overline{) 385} \end{array}$$

55

(Total for Question 6 is 4 marks)



- 7 The graph shows the volume of water, V litres, in a tank at time t seconds.

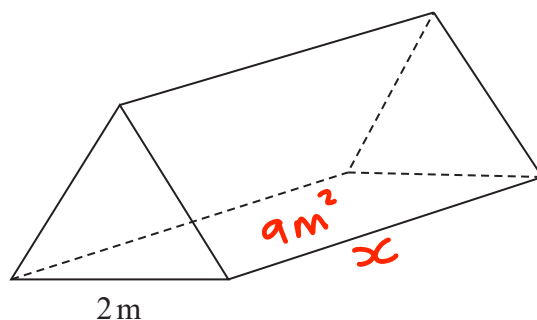


What does the gradient of this graph represent?

The amount of water (litres) lost per second

(Total for Question 7 is 1 mark)

- 8 The diagram shows a solid triangular prism on a horizontal floor.

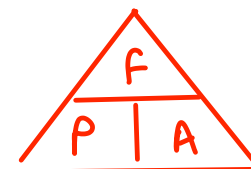


$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

The face in contact with the floor is a rectangle of width 2 m.

The pressure on the floor due to the prism is 80 newtons/m²
The force exerted by the prism on the floor is 720 newtons.

Work out the length of the prism.



$$A = \frac{F}{P} = \frac{720}{80} = \frac{72}{8} = 9$$

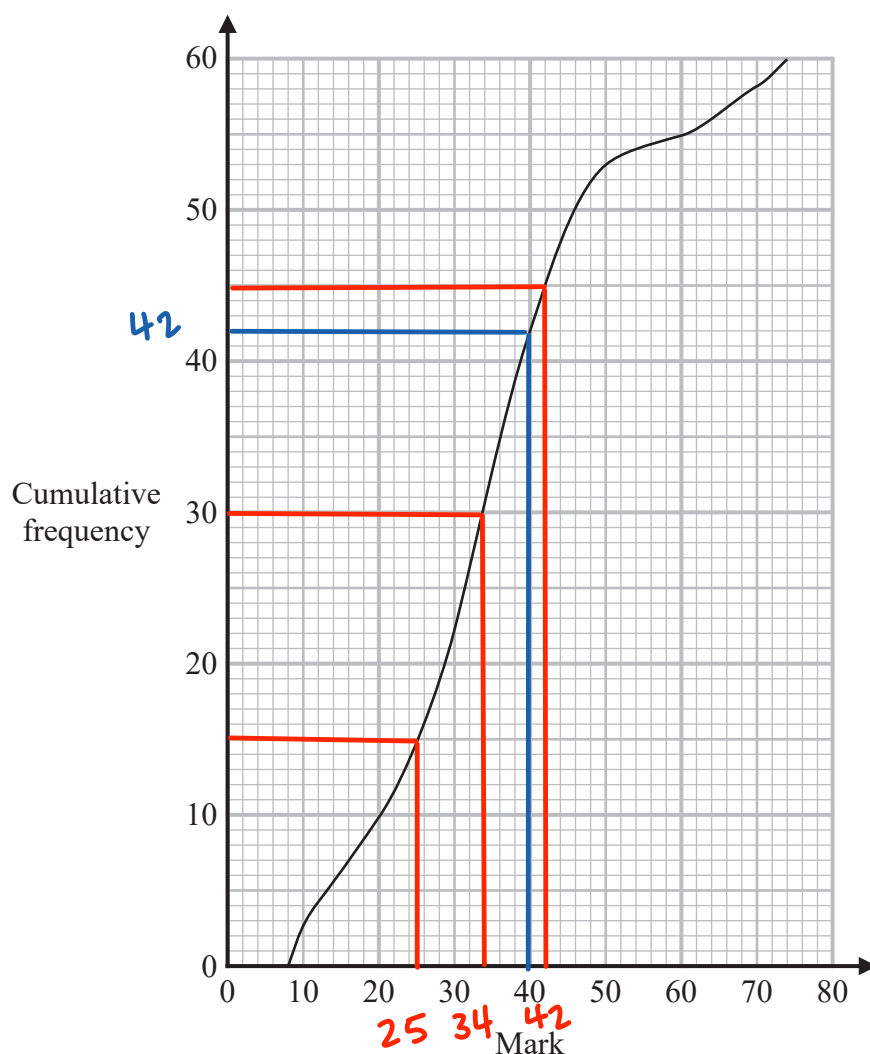
$$\begin{array}{r|l} 2 \times x & = 9 \\ \div 2 & \div 2 \\ \hline x & = 4.5 \end{array}$$

4.5

..... m

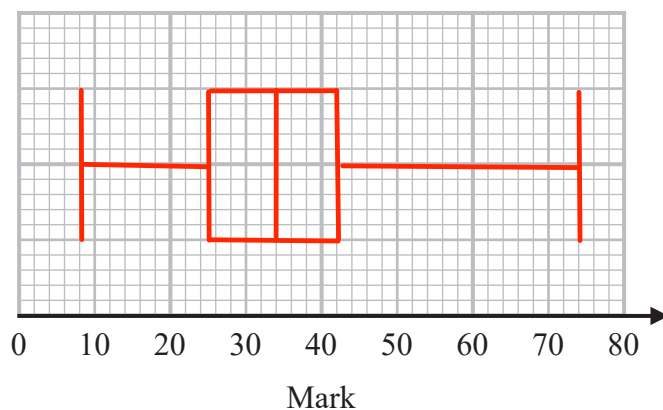
(Total for Question 8 is 3 marks)

- 9 The cumulative frequency graph gives information about the marks that 60 students got in a test.



For these 60 students
 the highest mark was 74
 the lowest mark was 8

- (a) On the grid below, draw a box plot for the distribution of the marks.



(3)

The pass mark for the test was 40

Sian says,

“30% of the 60 students passed the test.”

(b) Is Sian correct?

You must show how you get your answer.

$$60 - 42 = 18 \text{ passed}$$

$$30\% \text{ of } 60 = 18$$

She is correct!

(3)

(Total for Question 9 is 6 marks)



10 (a) Work out $25^{\frac{1}{2}} \times 8^{\frac{1}{3}}$

$$\sqrt{25} \times \sqrt[3]{8}$$

$$= 5 \times 2$$

10

(2)

(b) Find the value of $\left(\frac{1}{32}\right)^{\frac{3}{5}}$

$$\sqrt[5]{\frac{1}{32}} = \left(\frac{1}{2}\right)^3$$

$\frac{1}{8}$

(2)

(Total for Question 10 is 4 marks)



11 Kate was asked to factorise $x^2 + 5x + 6$ in the form $(x + a)(x + b)$

Kate says,

“The sum of a and b must be 6 and the product of a and b must be 5”

(a) Explain what is wrong with Kate’s statement.

The sum of a and b must be 5 and the product must be 6

(1)

(b) Factorise fully $2m^2 - 2$

$$2(m^2 - 1)$$

$$2(m - 1)(m + 1)$$

(2)

(c) Factorise fully $ax + bx - ay - by$

$$x(a + b) - y(a + b)$$

$$(x - y)(a + b)$$

(2)

(Total for Question 11 is 5 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



12 A, B and C are three solid spheres.

Sphere A has a volume of 64 cm^3

Sphere B has a volume of 125 cm^3

The radius of sphere C is 50% of the radius of sphere B.

Work out the ratio of the surface area of sphere A to the surface area of sphere C.

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

	A : B		B : C
LSF	4 : 5	LSF	2 : 1
ASF	16 : 25	ASF	4 : 1
VSF	64 : 125	VSF	

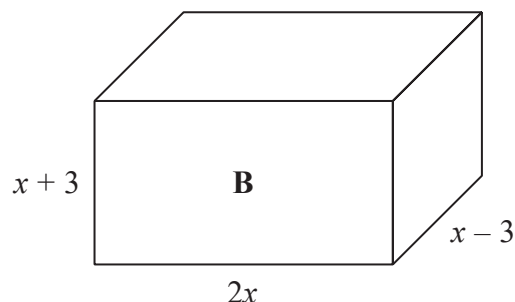
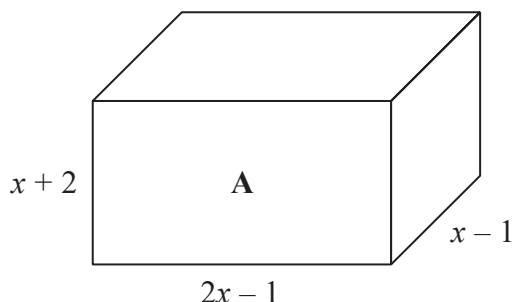
	A : B	B : C
$\times 4$ ↙	16 : 25	4 : 1
	64 : 100	100 : 25 ↘ $\times 25$

$$\begin{array}{l} A : B : C \\ 64 : 100 : 25 \end{array}$$

$$64 : 25$$

(Total for Question 12 is 4 marks)

13 Here are two cuboids.



All lengths are measured in centimetres.

The volume of cuboid A is 142 cm^3 greater than the volume of cuboid B.

Work out the value of x .

$$\textcircled{A} (x+2)(2x-1) = 2x^2 - x + 4x - 2 \\ = 2x^2 + 3x - 2$$

$$(2x^2 + 3x - 2)(x-1) = 2x^3 - 2x^2 + 3x^2 - 3x - 2x + 2 \\ = 2x^3 + x^2 - 5x + 2$$

$$\textcircled{B} 2x(x+3) = 2x^2 + 6x$$

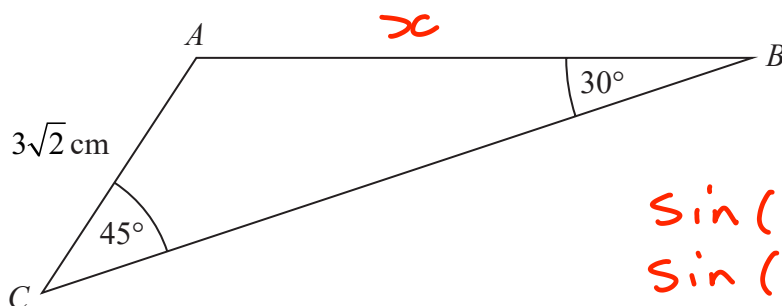
$$(2x^2 + 6x)(x-3) = 2x^3 - 6x^2 + 6x^2 - 18x \\ = 2x^3 - 18x$$

$$\begin{array}{r|l} 2x^3 + x^2 - 5x + 2 & = 2x^3 - 18x + 142 \\ -2x^3 & -2x^3 \\ \hline x^2 - 5x + 2 & = -18x + 142 \\ +18x & +18x \\ \hline x^2 + 13x + 2 & = 142 \\ -142 & -142 \\ \hline x^2 + 13x - 140 & = 0 \\ (x+20)(x-7) & = 0 \\ x = -20 & \\ x = 7 & \end{array}$$

$$x = 7$$

(Total for Question 13 is 5 marks)

14 ABC is a triangle.



$$\sin(30) = \frac{1}{2}$$

$$\sin(45) = \frac{\sqrt{2}}{2}$$

Work out the length of AB .

$$\frac{x}{\sin(45)} = \frac{3\sqrt{2}}{\sin(30)}$$

$$\times \frac{1}{2} \quad \frac{x}{\sqrt{2}/2} = \frac{3\sqrt{2}}{1/2} \quad \times \frac{1}{2}$$

$$\frac{x}{\sqrt{2}} = 3\sqrt{2}$$

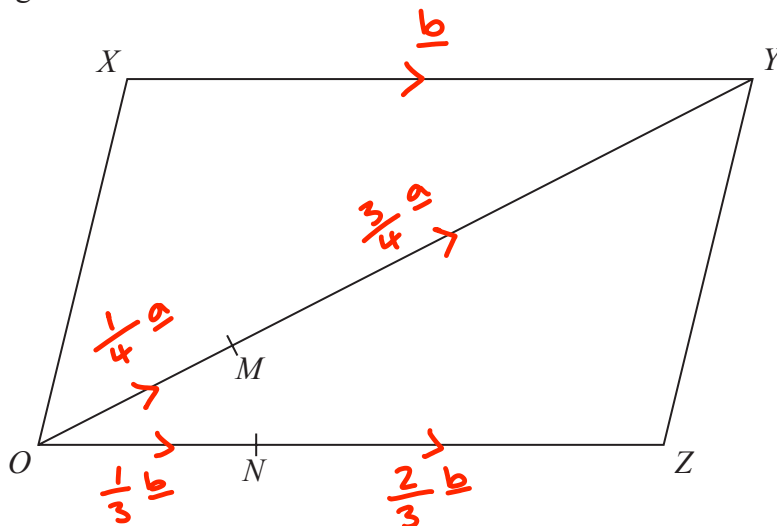
6

..... cm

(Total for Question 14 is 3 marks)

$$\begin{array}{l} \times \sqrt{2} \\ x \\ x \end{array} \quad \begin{array}{l} = \\ = \\ = \end{array} \quad \begin{array}{l} 3\sqrt{2} \\ 3(2) \\ 6 \end{array}$$

15 $OXYZ$ is a parallelogram.



$$\vec{OY} = \mathbf{a} \text{ and } \vec{OZ} = \mathbf{b}$$

M is the point on OY such that $OM:MY = 1:3$

N is the point on OZ such that $ON:NZ = 1:2$

Work out the ratio $XN:MN$

You must show all your working.

$$\begin{aligned} \vec{XN} &= \vec{XY} - \vec{YN} \\ &= \vec{b} - \vec{a} + \frac{1}{3}\vec{b} \\ &= -\vec{a} + \frac{4}{3}\vec{b} \end{aligned}$$

$$\begin{aligned} \vec{MN} &= \vec{MO} + \vec{ON} \\ &= -\frac{1}{4}\vec{a} + \frac{1}{3}\vec{b} \end{aligned}$$

$$\vec{XN} = -\vec{a} + \frac{4}{3}\vec{b}$$

$$\vec{MN} = -\frac{1}{4}\vec{a} + \frac{1}{3}\vec{b}$$

$$\vec{XN} = \vec{MN} \times 4$$

$$4:1$$

(Total for Question 15 is 4 marks)



16 (a) Rationalise the denominator of $\frac{15}{\sqrt{5}}$

Give your answer in its simplest form.

$$\frac{15}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{15\sqrt{5}}{5}$$

$$\frac{3\sqrt{5}}{(2)}$$

(b) Write $\frac{\sqrt{75} - 2}{1 + 2\sqrt{3}}$ in the form $\frac{a - b\sqrt{3}}{c}$ where a , b and c are integers.

$$\sqrt{75} = \sqrt{25} \times \sqrt{3} = 5\sqrt{3}$$

$$\frac{(5\sqrt{3} - 2)}{(1 + 2\sqrt{3})} \times \frac{(1 - 2\sqrt{3})}{(1 - 2\sqrt{3})}$$

$$= \frac{\overset{-30}{5\sqrt{3} - 10(3)} - 2 + 4\sqrt{3}}{1 - 2\sqrt{3} + 2\sqrt{3} - 4(3)}$$

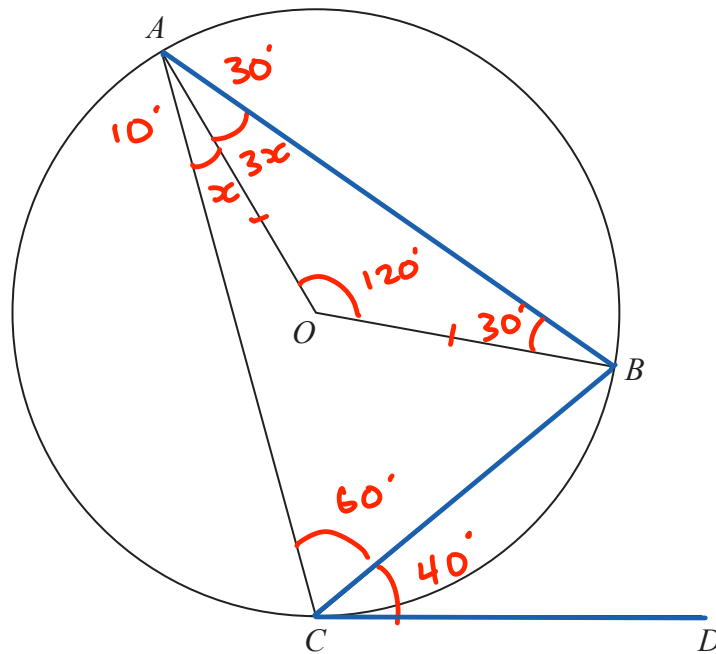
$$= \frac{9\sqrt{3} - 32}{-11}$$

$$= \frac{32 - 9\sqrt{3}}{11}$$

(4)

(Total for Question 16 is 6 marks)

17 A , B and C are points on a circle, centre O .



CD is a tangent to the circle.

Angle $BCD = 40^\circ$

Angle $OAB = 3 \times \text{angle } OAC$

Work out the size of angle ACD .

Write down any circle theorems that you use.

$\angle BAC = 40^\circ$ (Alternate segment theorem)

$$4x = 40$$

$$x = 10$$

$\angle ACB = 60^\circ$ (angles at the centre are twice the angle at the circumference)

$$60^\circ + 40^\circ =$$

100

(Total for Question 17 is 4 marks)



18 $f(x) = \frac{5x-3}{4}$

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

$$y = \frac{5x-3}{4}$$

$$4y = 5x - 3$$

$$4y + 3 = 5x$$

$$\frac{4y+3}{5} = x$$

$$f^{-1}(x) = \frac{4x+3}{5} \quad (2)$$

For all values of x

$$g(x) = (x-1)^2 \text{ and } h(x) = 1-2x$$

(b) Work out the value of $gh(5)$

$$h(5) = 1 - 2(5) = 1 - 10 = -9$$

$$g(-9) = (-9-1)^2 = (-10)^2 = 100$$

$$gh(5) = 100 \quad (2)$$

(Total for Question 18 is 4 marks)

- 19 In the semi-finals of a chess tournament,
 player A will play player B
 and player C will play player D.

The two winners will then play each other in the final.

The probability that player A will win against player B is 0.6

The probability that player A will win against player C is 0.5

The probability that player A will win against player D is 0.3

The probability that player C will win against player D is 0.2

Work out the probability that player A will win the chess tournament.

Semi-finals (the ways that A can make it to the final)

$$A \text{ wins, C wins} = 0.6 \times 0.2 = 0.12$$

$$A \text{ wins, D wins} = 0.6 \times 0.8 = 0.48$$

Finals (the ways that A can win)

$$A \text{ and C final, A wins} = 0.12 \times 0.5 = 0.060$$

$$A \text{ and D final, A wins} = 0.48 \times 0.3 = 0.144$$

$$\begin{array}{r} 0.144 \\ + 0.060 \\ \hline 0.204 \end{array}$$

$$\begin{array}{r} 48 \\ \times 3 \\ \hline 144 \\ \times \end{array}$$

0.204

(Total for Question 19 is 4 marks)



20 C is the circle with equation $x^2 + y^2 = 4$ $r = 4$

Find an equation of the tangent to C at the point $(p, 1)$ where $p > 0$

Give your answer in the form $y + \sqrt{a}x = b$ where a and b are integers.

You must show all your working.

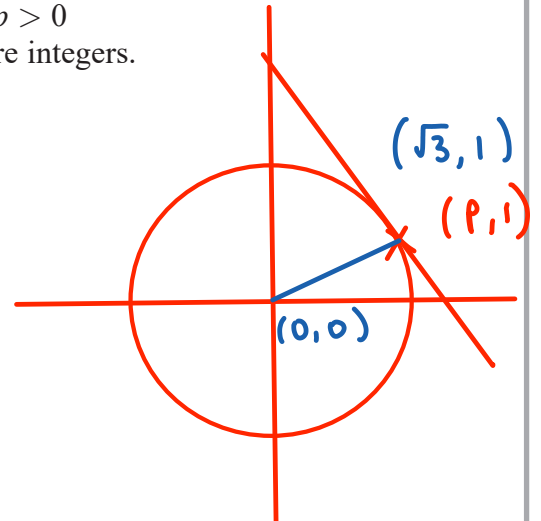
$$x^2 + y^2 = 4$$

$$p^2 + 1^2 = 4$$

$$p^2 + 1 = 4$$

$$p^2 = 3$$

$$p = \sqrt{3}$$



$$\text{Gradient of radius} = \frac{1 - 0}{\sqrt{3} - 0} = \frac{1}{\sqrt{3}}$$

$$\text{Gradient of Tangent} = -\sqrt{3}$$

$$y = -\sqrt{3}x + c$$

$$1 = -\sqrt{3}(\sqrt{3}) + c$$

$$1 = -3 + c$$

$$4 = c$$

$$y = -\sqrt{3}x + 4$$

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

(Total for Question 20 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS