Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Work out $818.4 \div 1.2$

$= 8184 \div 12$

$$12\overline{)8^{8}1^{9}8^{2}4}$$

682

(Total for Question 1 is 3 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

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

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

$\frac{1-0.7}{2} = 0.15$

500×0.15

$= 5 \times 15$

$\begin{array}{r} 15 \\ \times\ 5 \\ \hline 75 \end{array}$

(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)?

It would increase

(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.

$= \frac{7}{2} - \frac{7}{6}$

$= \frac{21}{6} - \frac{7}{6}$

$= \frac{14}{6} = \frac{7}{3} = 2\frac{1}{3}$

(2)

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

$= \frac{21}{4} \div \frac{7}{3}$

$= {}^{3}\cancel{\frac{21}{4}} \times \frac{3}{\cancel{7}_{1}}$

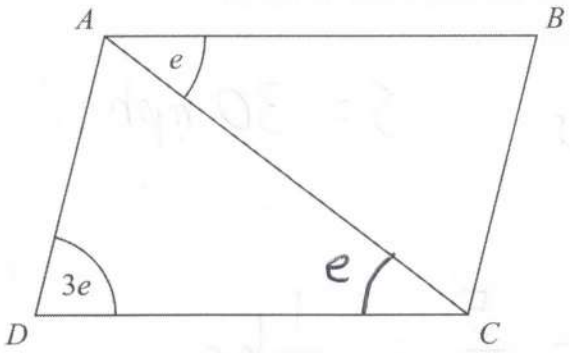
$= \frac{9}{4} = 2\frac{1}{4}$

(3)

(Total for Question 3 is 5 marks)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

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.

$\angle ACD = e$ (alternate angles are equal)

angles in a triangle sum to 180

so $\angle CAD = 180 - 3e - e$

$= 180 - 4e$

(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.

D = 5 miles S = 30 mph

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

10 minutes

(3)

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

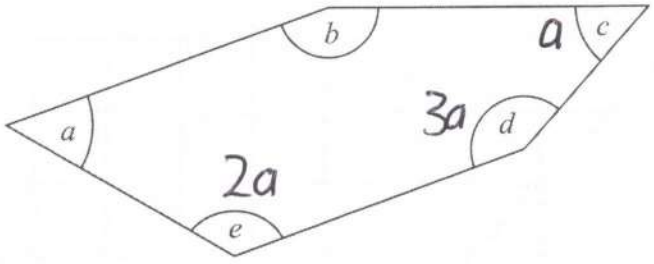
Distance was rounded up, speed was rounded down up so over estimate

(1)

(Total for Question 5 is 4 marks)

6 Here is a pentagon.

155



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

Work out the size of angle a

Total = (5-2) x 180
= 540°

7a + 155 = 540
7a = 385

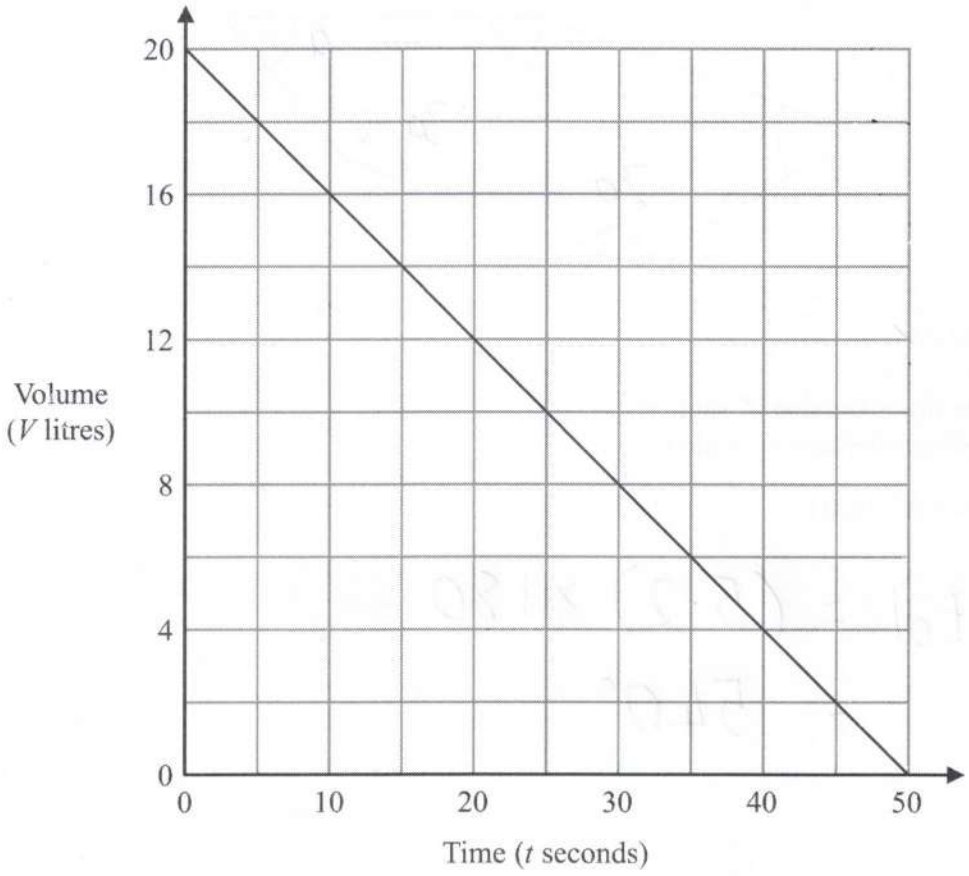
$$7\overline{)385} = 55$$

55 °

(Total for Question 6 is 4 marks)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

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

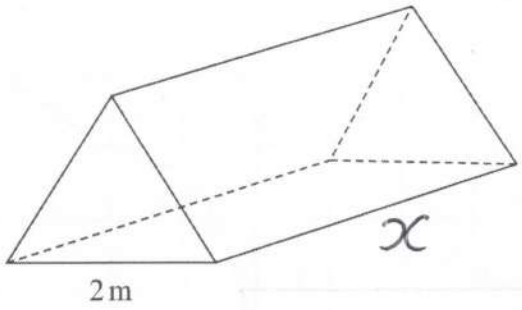


What does the gradient of this graph represent?

The rate of decrease of the volume of water over time.

(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/m^2
The force exerted by the prism on the floor is 720 newtons.

Work out the length of the prism.

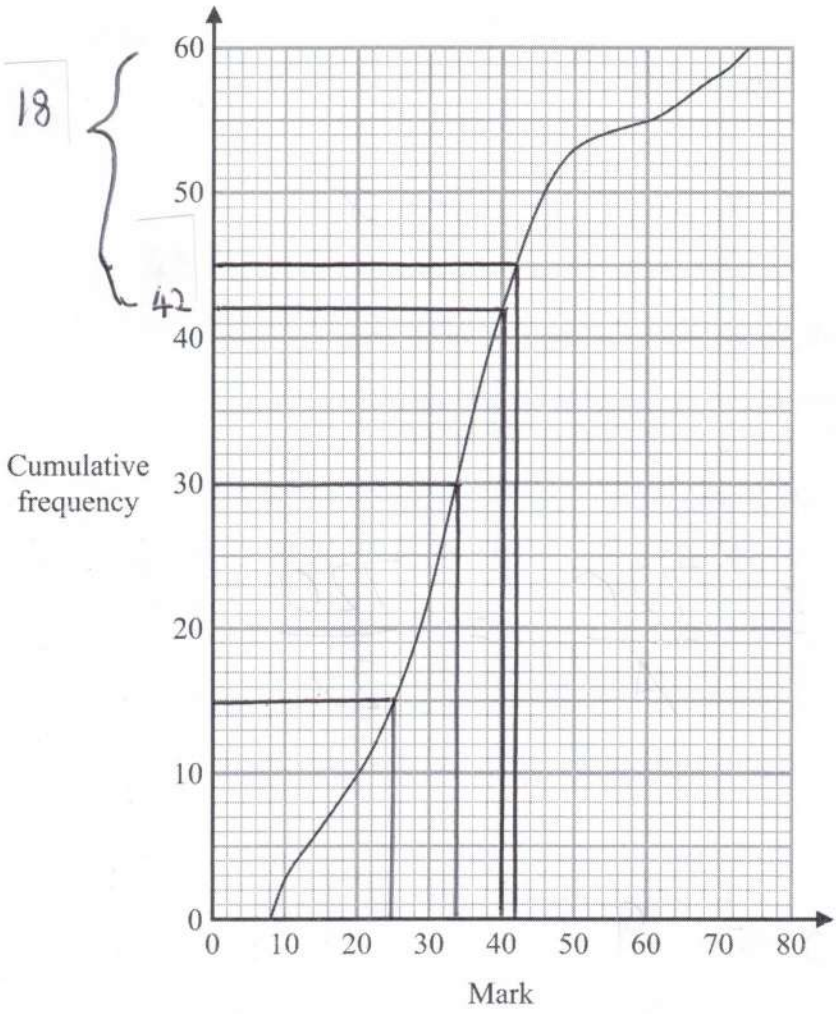
$$80 = \frac{720}{A} = \frac{720}{2x}$$

$$2x = 9$$

$x = 4.5$ m

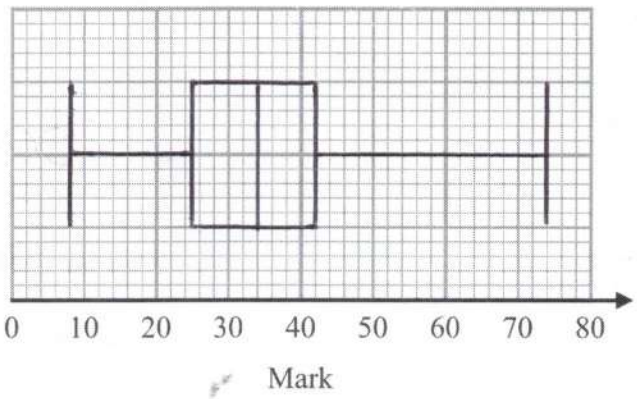
(Total for Question 8 is 3 marks)

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.

$\text{Pass} = \frac{18}{60} = \frac{6}{20} = \frac{30}{100} = 30\%$

so Yes

(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 $\left(\frac{1}{32}\right)^{\frac{3}{5}}$

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

$\frac{1}{8}$

(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.

Wrong way around $a \times b = 6$
$a + b = 5$

(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)

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 C

Vol s.f. $\times \frac{125}{64}$

$\sqrt[3]{}$

Length s.f. $\times \frac{5}{4}$ $\times \frac{1}{2}$

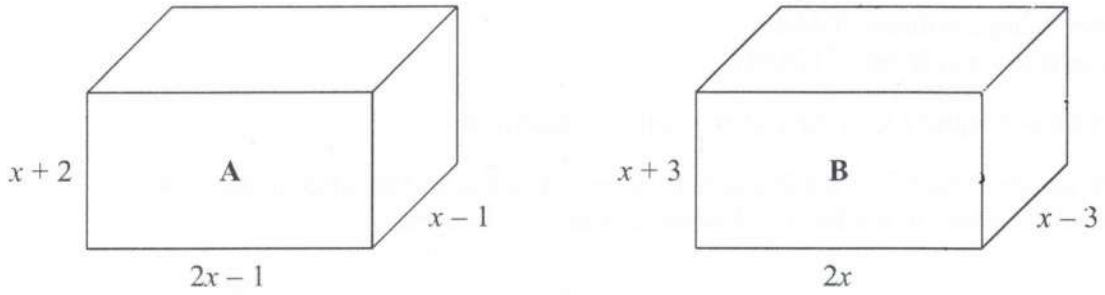
64 : 25

(Total for Question 12 is 4 marks)

Area sf $\times \frac{25}{16}$ $\times \frac{1}{4}$ $= \frac{25}{64}$

A → C

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.

$A = (x+2)(x-1)(2x-1)$

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

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

$= 2x^3 + x^2 - 5x + 2$

$B = (2x^2 + 6x)(x-3)$

$= 2x^3 + 0x^2 - 18x$

$2x^3 + x^2 - 5x + 2 = 2x^3 - 18x + 142$

$x^2 + 13x - 140 = 0$

$(x+20)(x-7)$

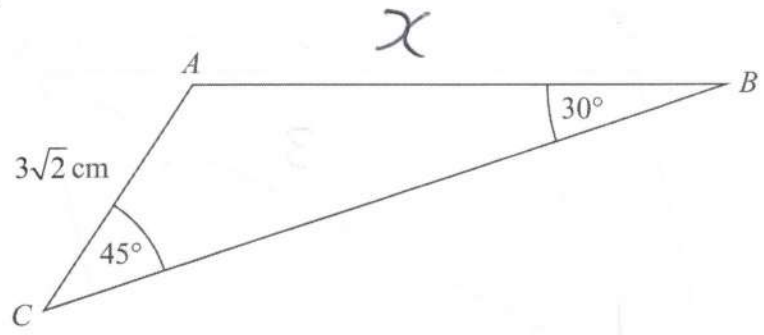
reject

$x = -20$

$x =$ 7

(Total for Question 13 is 5 marks)

14 ABC is a triangle.



Work out the length of AB.

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

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

$$x = 3 \times 2$$

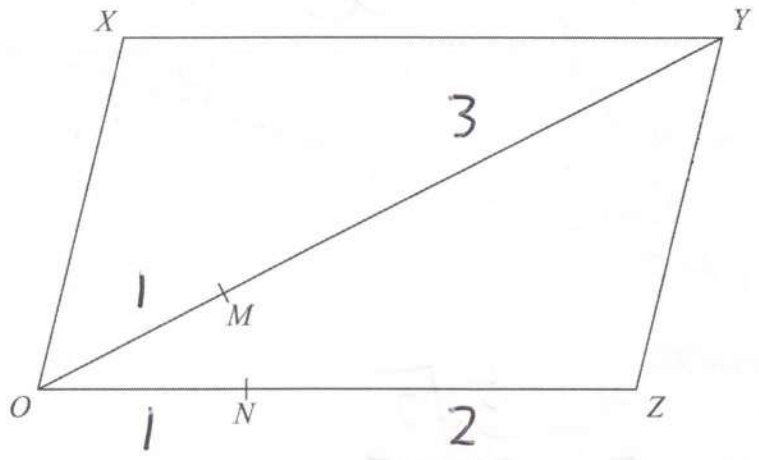
6

..... cm

(Total for Question 14 is 3 marks)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

15 $OXYZ$ is a parallelogram.



a / b

$\overrightarrow{OY} = \mathbf{a}$ and $\overrightarrow{OZ} = \mathbf{b}$

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.

$\overrightarrow{ZY} = -b + a = \overrightarrow{OX}$

$\overrightarrow{XN} = \overrightarrow{XO} + \overrightarrow{ON}$
$= b - a + \frac{1}{3}b = \frac{4}{3}b - a$

$\overrightarrow{MN} = \overrightarrow{MO} + \overrightarrow{ON}$
$= -\frac{1}{4}a + \frac{1}{3}b = \frac{1}{3}b - \frac{1}{4}a$

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

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.

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

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

$= 3\sqrt{5}$

(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.

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

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

$= \frac{5\sqrt{3} - 10\sqrt{9} - 2 + 4\sqrt{3}}{1 - 4\sqrt{9}}$

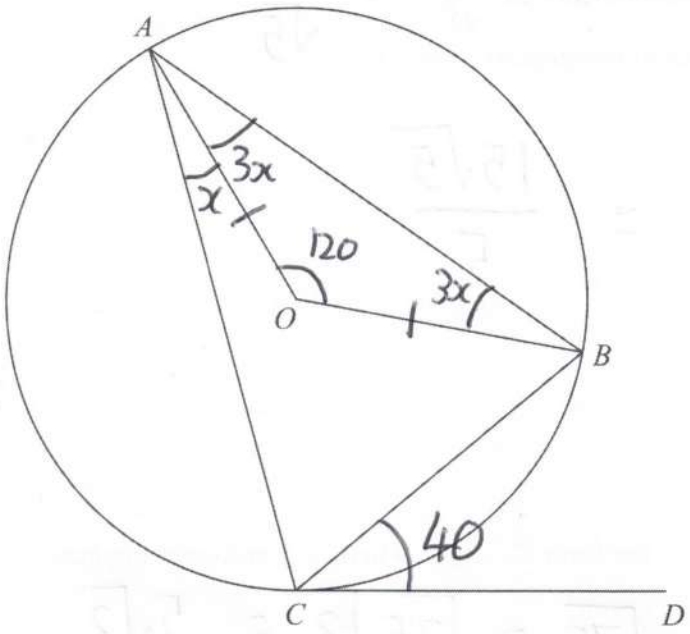
$= \frac{9\sqrt{3} - 32}{-11}$

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

(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 $BCD = 40°$
Angle $OAB = 3 \times$ angle OAC

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

$\angle CAB = 40$ (alternate segment theorem)

$4x = 40$

$x = 10$

$\angle AOB = 180 - 60 = 120°$

$\angle ACB = 60$ (angle at the centre is twice the angle at the arc)

$\angle ACD = 60 + 40 = 100°$

(Total for Question 17 is 4 marks)

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

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

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

$4y = 5x - 3$

$4y + 3 = 5x$

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

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

(2)

For all values of x

$g(x) = (x - 1)^2$ and $h(x) = 1 - 2x$

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

$h(5) = 1 - 2 \times 5 = -9$

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

$= 10^2$

$gh(5) = 100$

(2)

(Total for Question 18 is 4 marks)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

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.

Awins tournament

$\Rightarrow$ Awins then beats C

+

Awins then beats D

$= (0.6 \times 0.2 \times 0.5) + (0.6 \times 0.8 \times 0.3)$

A C A A D A

$= 0.060 + 0.144$

0.144
$+ 0.060$
0.204

0.204

(Total for Question 19 is 4 marks)

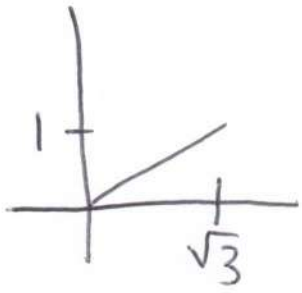
DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

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

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.

At $y = 1$, $p^2 + 1 = 4$

$p = \sqrt{3} = x$



$m_R = \frac{1}{\sqrt{3}}$

$m_{tangent} = -\sqrt{3}$

use $y = mx + c$

$1 = -\sqrt{3} \times \sqrt{3} + c$

$4 = c$

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

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

(Total for Question 20 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS