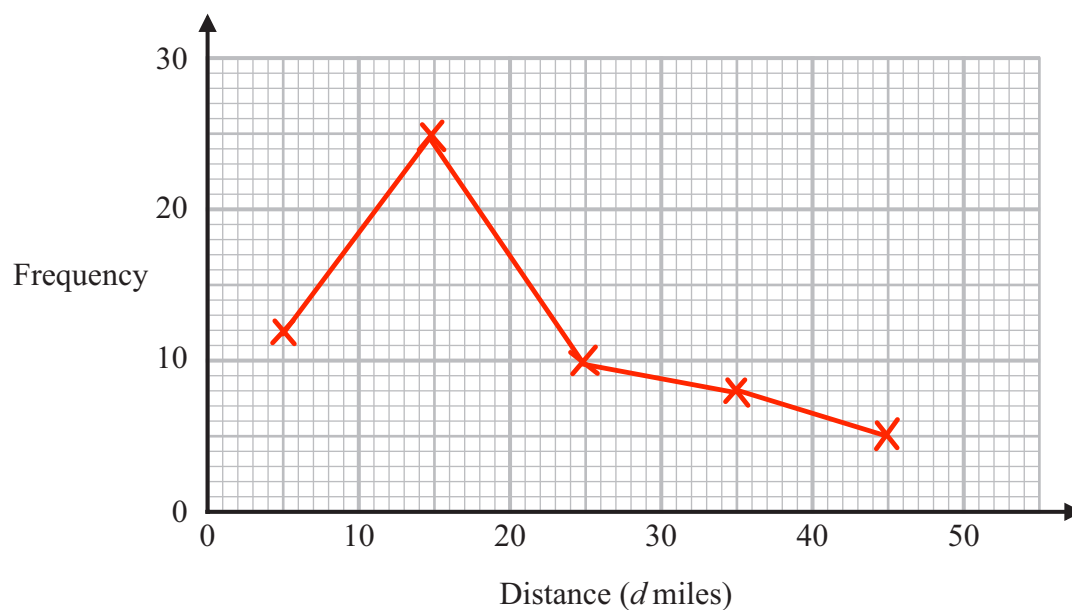




- 1 The table shows information about the distances that 60 people travel to work.

Distance (d miles)	Frequency
$0 < d \leq 10$	12
$10 < d \leq 20$	25
$20 < d \leq 30$	10
$30 < d \leq 40$	8
$40 < d \leq 50$	5

Draw a frequency polygon for the information in the table.



(Total for Question 1 is 2 marks)



- 2 Ben is trying to make m the subject of $p = \frac{m}{3} + 5$

Here is his working.

$$p - 5 = \frac{m}{3}$$

$$3 \times p - 5 = m$$

$$m = 3p - 5$$

Ben's answer is wrong.

- (a) What mistake has Ben made?

He should of multiplied both p and -5 by 3, so $m = 3p - 15$.

(1)

- (b) Factorise fully $2x^3y + 4xy^2$

$$2xy(x^2 + 2y)$$

(2)

(Total for Question 2 is 3 marks)

3 Mia pays £25 for 200 oranges.

Mia puts the oranges into bags.
She puts 5 oranges into each bag.

$$200 \div 5 = 40 \text{ bags}$$

Mia sells all the bags of oranges for £1 each bag. = £40

Work out Mia's percentage profit.

$$\frac{\text{change}}{\text{original}} \times 100$$

$$\frac{15}{25} \times 100 = 60$$

60 %

(Total for Question 3 is 3 marks)

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- 4 In London, 2 kg of carrots cost £3.75
In New York, 5 lbs of carrots cost 4.90 US dollars.

£1 = 1.20 US dollars

1 kg = 2.2 lbs

In which city are carrots better value for money, London or New York?
You must show how you get your answer.

London

$$2 \text{ kg} = £3.75$$

$$\times 1.20$$

$$2 \text{ kg} = 4.5 \text{ USD}$$

$$\times 2.2$$

$$4.4 \text{ lbs} = 4.5 \text{ USD}$$

$$1 \text{ lb} = 1.02 \text{ USD}$$

New York

$$5 \text{ lbs} = 4.90 \text{ USD}$$

$$1 \text{ lb} = 0.98 \text{ USD}$$

New York!

(Total for Question 4 is 4 marks)

- 5 Karim rounds a number, n , to 1 decimal place.
The result is 23.8

Complete the error interval for n .

$$\underline{23.75} \leq n < \underline{23.85}$$

(Total for Question 5 is 2 marks)

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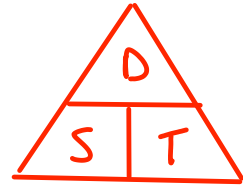
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- 6 A plane takes 2 hours 24 minutes to fly from Luton to Alicante.
The plane flies a distance of 1512 kilometres.

Work out the average speed of the plane.
Give your answer in kilometres per hour.



$$\frac{1512}{2 \text{ hr } 24 \text{ min}} = 630$$

OR

$$\frac{1512}{2.4} = 630$$

630 kilometres per hour

(Total for Question 6 is 3 marks)

$$24 \text{ mins} \div 60 = 0.4 \text{ hours}$$

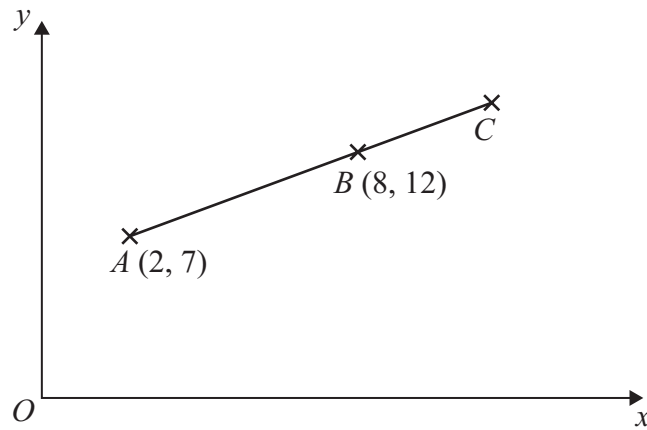
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7 ABC is a straight line.



Point A has coordinates $(2, 7)$

Point B has coordinates $(8, 12)$

$$BC = \frac{1}{2} AB$$

Find the coordinates of point C .

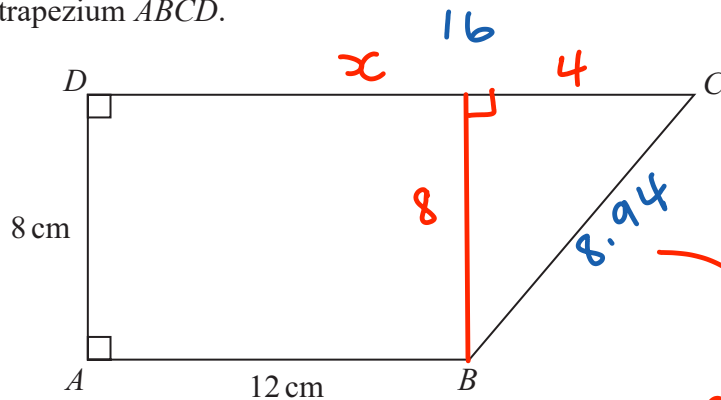
$\div 2$ $A \rightarrow B : \rightarrow 6, \uparrow 5$
 $B \rightarrow C : \rightarrow 3, \uparrow 2.5$ $\div 2$

$$B = (8, 12) \quad C = (11, 14.5)$$

(..... 11 , 14.5)

(Total for Question 7 is 3 marks)

8 The diagram shows trapezium $ABCD$.



$$AB = 12 \text{ cm}$$

$$AD = 8 \text{ cm}$$

The trapezium has an area of 112 cm^2

Work out the perimeter of the trapezium.

Give your answer correct to 3 significant figures.

$$\frac{1}{2}(a+b) \times h = 112$$

$$\frac{1}{2}(x+12) \times 8 = 112$$

$$(x+12) \times 8 = 224$$

$$\begin{array}{rcl} x+12 & = & 28 \\ -12 & & -12 \\ \hline x & = & 16 \end{array}$$

$$16 + 8 + 12 + 8.94 = 44.94$$

$$44.9 \text{ cm}$$

(Total for Question 8 is 5 marks)

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- 9 (a) Write 5.73×10^6 as an ordinary number.

573 0000
.....
(1)

- (b) Write 0.035 in standard form.

3.5×10^{-2}
.....
(1)

(Total for Question 9 is 2 marks)

10 Use your calculator to work out $\frac{(1.8^3 \times \cos 35^\circ)^2}{\sqrt[3]{17.4 - \tan 85^\circ}}$

Give your answer correct to 3 significant figures.

$$= 12.58077014$$

$$12.6$$

(Total for Question 10 is 2 marks)



11 $\frac{3^n \times 3^{20}}{3^8} = 3^{14}$

(a) Find the value of n .

$$n + 20 - 8 = 14$$

$$\begin{array}{r|l} n + 12 & = 14 \\ -12 & -12 \\ \hline n & = 2 \end{array}$$

$$n = \underline{2} \quad (2)$$

(b) Write $(64m^{12})^{\frac{2}{3}}$ in the form am^b where a and b are integers.

$$\begin{aligned} \sqrt[3]{64m^{12}} &= (4m^4)^2 \\ &= 4m^4 \times 4m^4 \end{aligned}$$

$$\underline{16m^8} \quad (2)$$

(Total for Question 11 is 4 marks)

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12 The price of a holiday is increased by 10%

After the increase, the price of the holiday is £440

Jim says,

“10% of £440 is £44 so the price of the holiday before the increase was £396”

(a) Is Jim correct?

Explain your answer.

No, he has found 10% of the increased price, not the original price

(1)

Tina sells bikes.

In November, Tina sold 25% fewer bikes than she sold in October.

In December, Tina sold 50% more bikes than she sold in November.

In December, Tina sold 180 bikes.

(b) How many bikes did Tina sell in October?

$$\begin{array}{rcl}
 \div 150 & 150\% & = 180 \\
 \downarrow & & \downarrow \div 150 \\
 1\% & = & 1.2 \\
 \downarrow \times 100 & & \downarrow \times 100 \\
 100\% & = & 120
 \end{array}$$

November

$$\begin{array}{rcl}
 \div 75 & 75\% & = 120 \\
 \downarrow & & \downarrow \div 75 \\
 1\% & = & 1.6 \\
 \downarrow \times 100 & & \downarrow \times 100 \\
 100\% & = & 160
 \end{array}$$

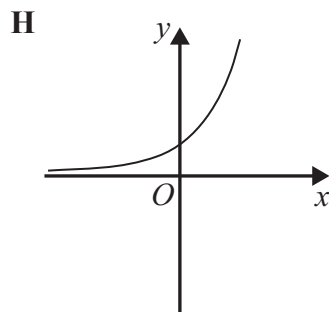
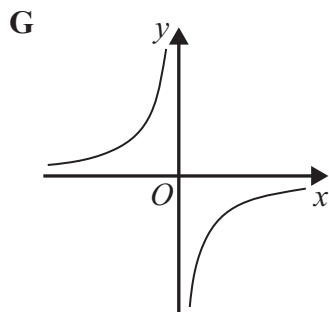
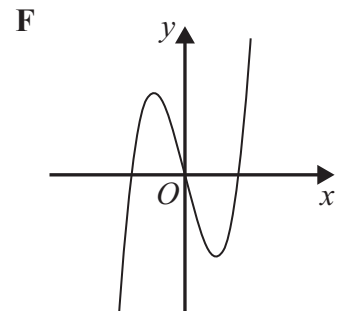
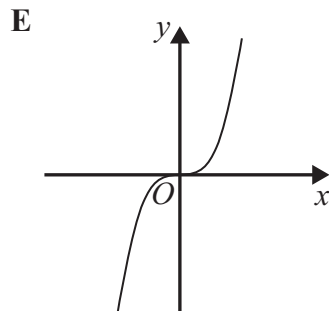
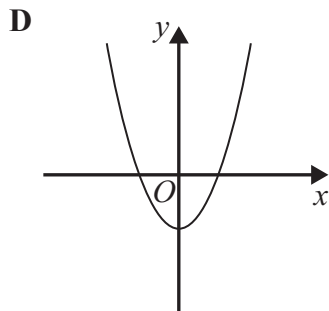
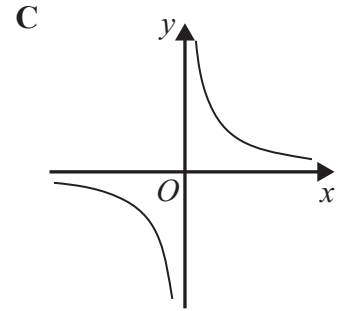
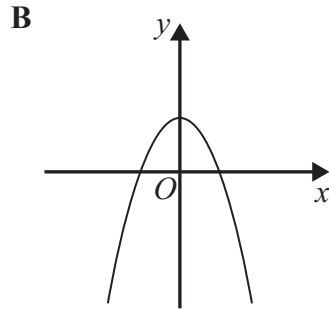
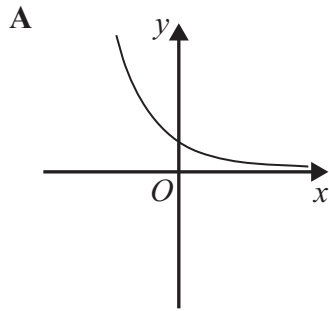
160

(3)

(Total for Question 12 is 4 marks)



13 Here are some graphs.



Each equation in the table is the equation of one of the graphs.

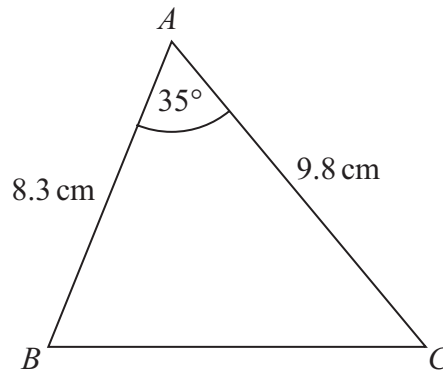
Complete the table.

Equation	Letter of graph
$y = x^3$	E
$y = \frac{2}{x}$	C
$y = 5 - x^2$	B
$y = 3^x$	H

(Total for Question 13 is 3 marks)



14 Here is triangle ABC .



Calculate the area of triangle ABC .

Give your answer correct to 3 significant figures.

$$\frac{1}{2} ab \sin C$$

$$\frac{1}{2} \times 8.3 \times 9.8 \times \sin(35)$$

$$= 23.327..$$

$$\underline{\underline{23.3}} \text{ cm}^2$$

(Total for Question 14 is 2 marks)



15 There are only 7 blue pens and 3 red pens in a box.

Raja takes at random one of the pens.

He notes the colour of the pen and puts the pen back into the box.

Raja does this two more times.

$$\text{Blue} = \frac{7}{10}$$

$$\text{Red} = \frac{3}{10}$$

Show that the probability that Raja takes at least two blue pens is $\frac{98}{125}$

Tip: I am using the rules of a probability tree but choosing not to draw one because the event is happening 3 times. When you go across a probability tree, you multiply!

$$b, b, b = \frac{7}{10} \times \frac{7}{10} \times \frac{7}{10} = \frac{343}{1000}$$

$$b, b, r = \frac{7}{10} \times \frac{7}{10} \times \frac{3}{10} = \frac{147}{1000}$$

$$b, r, b = \frac{7}{10} \times \frac{3}{10} \times \frac{7}{10} = \frac{147}{1000}$$

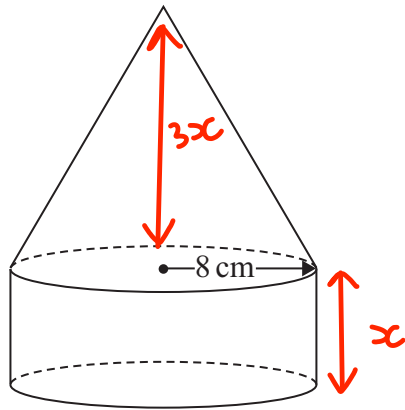
$$r, b, b = \frac{3}{10} \times \frac{7}{10} \times \frac{7}{10} = \frac{147}{1000}$$

$$\frac{343}{1000} + \frac{147}{1000} + \frac{147}{1000} + \frac{147}{1000}$$

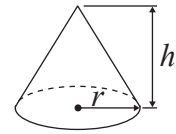
$$= \frac{98}{125}$$

(Total for Question 15 is 4 marks)

16 The diagram shows a solid shape made from a cylinder and a cone.



$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h$$



$$\text{Cylinder} = \pi r^2 h$$

The cone has a base radius of 8 cm.
The cylinder has a radius of 8 cm.

The vertical height of the cone is three times the height of the cylinder.

The volume of the solid shape is $640\pi \text{ cm}^3$

Work out the vertical height of the cone.
You must show all your working.

$$\text{Cone} = \frac{1}{3} \times \pi \times 8^2 \times 3x = 64\pi x$$

$$\text{Cylinder} = \pi \times 8^2 \times x = 64\pi x$$

$$\underline{128\pi x}$$

$$\begin{array}{r|l} 128\cancel{\pi}x & = 640\cancel{\pi} \\ \div 128 & \div 128 \\ x & = 5 \end{array}$$

↪ Total volume

$$5 \times 3 = 15$$

15

..... cm

(Total for Question 16 is 4 marks)



17 Solve $\frac{5x}{3x-1} - \frac{2x}{3x+1} = 1$

$$(3x+1)(3x-1) = 9x^2 - 1$$

$$\frac{5x(3x+1)}{(3x-1)(3x+1)} - \frac{2x(3x-1)}{(3x-1)(3x+1)} = 1$$

$$\frac{15x^2 + 5x}{9x^2 - 1} - \frac{6x^2 - 2x}{9x^2 - 1} = 1$$

$$\frac{9x^2 + 7x}{9x^2 - 1} = 1$$

$$\cancel{9x^2} + 7x = \cancel{9x^2} - 1$$

$$7x = -1$$

$$x = -\frac{1}{7}$$

$$x = -\frac{1}{7}$$

(Total for Question 17 is 3 marks)

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18 Magda carried out a survey to find out the drinks that people like.

She asked 100 people if they like coffee (C) or tea (T) or hot chocolate (H).

32 people like all three drinks.

15 people like coffee and hot chocolate but **not** tea.

43 people like coffee and tea.

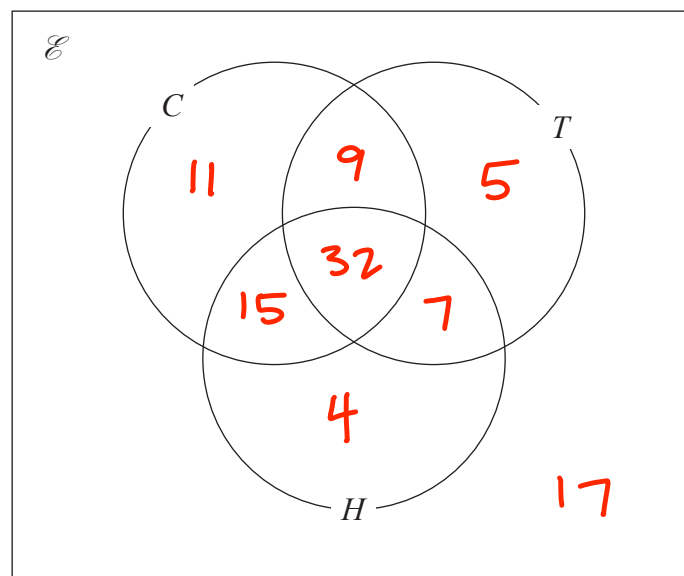
39 people like tea and hot chocolate.

67 people like coffee.

58 people like hot chocolate.

5 people like **only** tea.

(a) Complete the Venn diagram for this information.



(4)

One of the people is chosen at random.

Given that this person likes coffee,

(b) find the probability that this person also likes hot chocolate.

Tip: The total number of people that like coffee is 67

$$\begin{array}{r} 47 \\ \hline 67 \end{array}$$

(2)

(Total for Question 18 is 6 marks)



19 There are some sheets of paper in a pile.

10.35 10.45

The height of the pile is 10.4 cm, correct to the nearest mm.

The thickness of each sheet of paper is 0.17 mm, correct to 2 significant figures.

0.165 0.175

Calculate the upper bound for the number of sheets of paper in the pile.

You must show all your working.

$$UB = \frac{UB}{LB} = \frac{10.45 \text{ cm}}{0.165 \text{ mm}}$$

Tip: We need to make sure the units are the same before we divide

$$= \frac{104.5 \text{ mm}}{0.165 \text{ mm}} = 633.\dot{3}$$

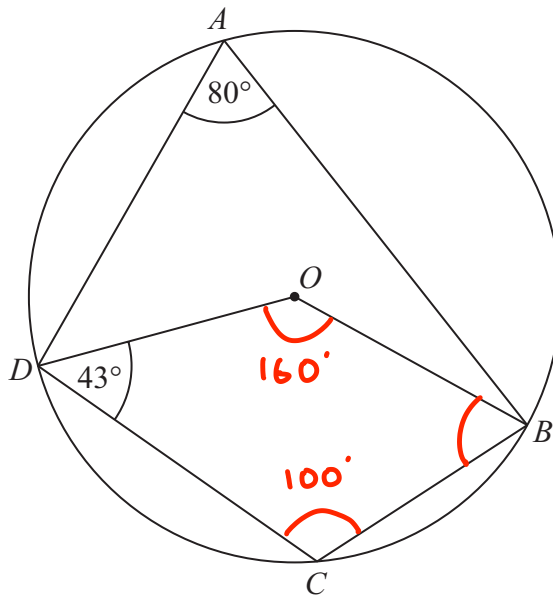
633

(Total for Question 19 is 3 marks)

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Find the size of angle OBC .

Write down any circle theorems that you use.

$\angle DOB = 80^\circ$ Angles at the centre are twice the angle at the circumference

$\angle DCB = 100^\circ$ Opposite angles in a cyclic quadrilateral add to 180°

51

(Total for Question 20 is 4 marks)



21 Solve algebraically the simultaneous equations

$$3x^2 + 2y^2 = 44$$

$$3x + y = 2$$

$$y = 2 - 3x$$

$$\begin{aligned} y^2 &= (2 - 3x)(2 - 3x) \\ &= 4 - 12x + 9x^2 \\ &= 9x^2 - 12x + 4 \end{aligned}$$

$$2y^2 = 18x^2 - 24x + 8$$

$$3x^2 + 18x^2 - 24x + 8 = 44$$

$$21x^2 - 24x + 8 = 44$$

$$21x^2 - 24x - 36 = 0$$

$$7x^2 - 8x - 12 = 0$$

↘ ÷3

$$7x^2 - 14x \mid + 6x - 12 = 0$$

$$7x(x-2) \mid 6(x-2) = 0$$

$$(7x + 6)(x - 2) = 0$$

$$\begin{array}{r} -84 \\ \hline 6, -14 \end{array}$$

$$x = -\frac{6}{7}, y = 2 - 3\left(-\frac{6}{7}\right) = \frac{32}{7}$$

$$x = 2, y = 2 - 3(2) = -4$$

$$x = -\frac{6}{7}, y = \frac{32}{7} \quad x = 2, y = -4$$

(Total for Question 21 is 5 marks)

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22 C is a circle with centre (0, 0)

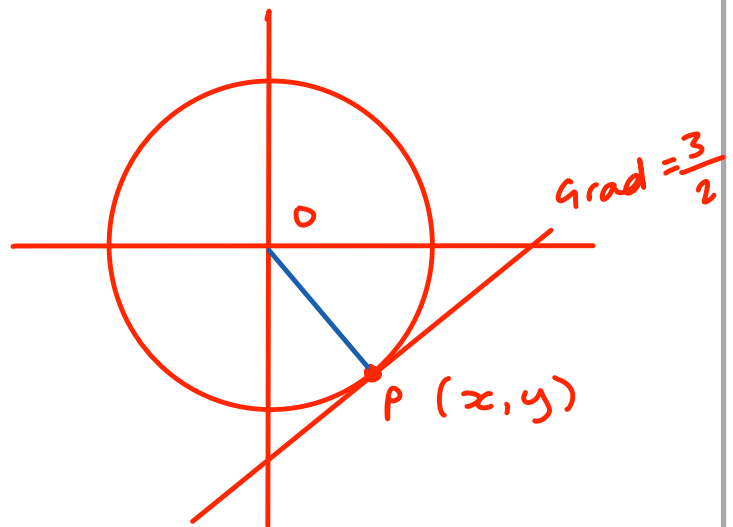
The straight line with equation $3x - 2y = 52$ is the tangent to C at the point P.

Find the coordinates of P.

$$2y + 52 = 3x$$

$$2y = 3x - 52$$

$$y = \frac{3}{2}x - 26$$



$$\text{Gradient } OP = -\frac{2}{3}$$

$$\text{Gradient} = \frac{\text{rise}}{\text{run}}, \quad \frac{y}{x} = -\frac{2}{3}$$

$$3y = -2x$$

$$y = -\frac{2}{3}x$$

Tip: When you have two fractions equal to each other you can cross multiply to remove the denominator

$$\frac{3}{2}x - 26 = -\frac{2}{3}x$$

$$\frac{13}{6}x = 26$$

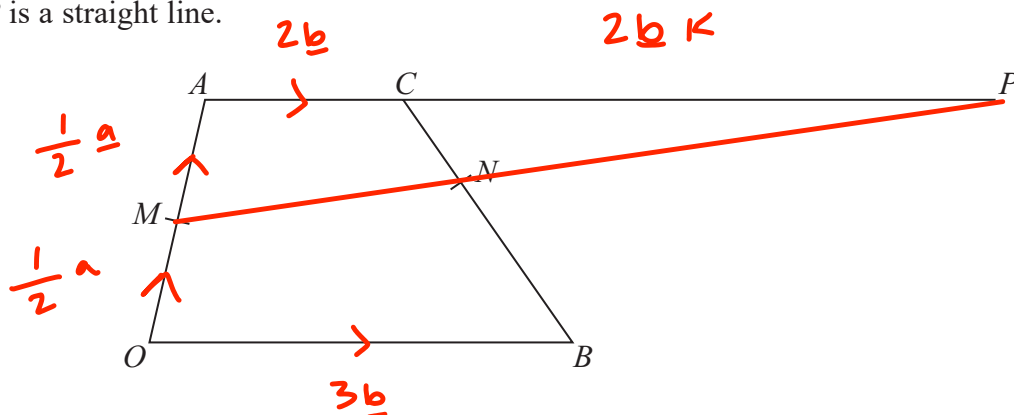
$$x = 12$$

$$y = -\frac{2}{3}(12) = -8$$

(12, -8)

(Total for Question 22 is 4 marks)

- 23 $OACB$ is a quadrilateral.
 ACP is a straight line.



M is the midpoint of OA .

N is the point on BC such that $BN:NC = 5:3$

$$\vec{OA} = \underline{a} \quad \vec{OB} = 3\underline{b} \quad \vec{AC} = 2\underline{b}$$

$$\vec{CP} = k \times \vec{AC} \quad \text{where } k \text{ is a scalar.}$$

$$\begin{aligned} \vec{CB} &= -2\underline{b} - \underline{a} + 3\underline{b} \\ &= -\underline{a} + \underline{b} \end{aligned}$$

Given that MNP is a straight line, find the value of k .
 You must show all your working.

Tip: Because MNP is a straight line, MP will be a multiple of MN

$$\begin{aligned} \vec{MN} &= \frac{1}{2} \underline{a} + 2\underline{b} + \frac{3}{8} \vec{CB} \\ &= \frac{1}{2} \underline{a} + 2\underline{b} + \frac{3}{8} (-\underline{a} + \underline{b}) \\ &= \frac{1}{2} \underline{a} + 2\underline{b} - \frac{3}{8} \underline{a} + \frac{3}{8} \underline{b} \\ &= \frac{1}{8} \underline{a} + \frac{19}{8} \underline{b} \end{aligned}$$

$$\vec{MP} = \frac{1}{2} \underline{a} + 2\underline{b} + 2\underline{b}k$$

$\times 4$

Tip: We know this
 as $\frac{1}{8} \times 4 = \frac{1}{2}$

$$\frac{19}{8} \times 4 = 2 + 2k$$

$$9.5 = 2 + 2k$$

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$$9.5 = 2 + 2K$$

$$7.5 = 2K$$

$$3.75 = K$$

$$k = 3.75$$

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS