Name: SOLUTIONS

GCSE 9-1 Higher
Practice Paper
Set C
Paper 3 - Calculator

Corbettmaths

Question	Mark	Available
1		3
2		3
3		3
4		3
5		3
6		6
7		3
8		4
9		4
10		3
11		3
12		5
13		3
14		3
15		7
16		3
17		5
18		4
19		5
20		3
21		4
Total		80

Equipment

1. A black ink ball-point pen.
2. A pencil.
3. An eraser.
4. A ruler.
5. A pair of compasses.
6. A protractor.
7. A calculator

Guidance

1. Read each question carefully.
2. Don't spend too long on one question.
3. Attempt every question.
4. Check your answers seem right.
5. Always show your workings

Information

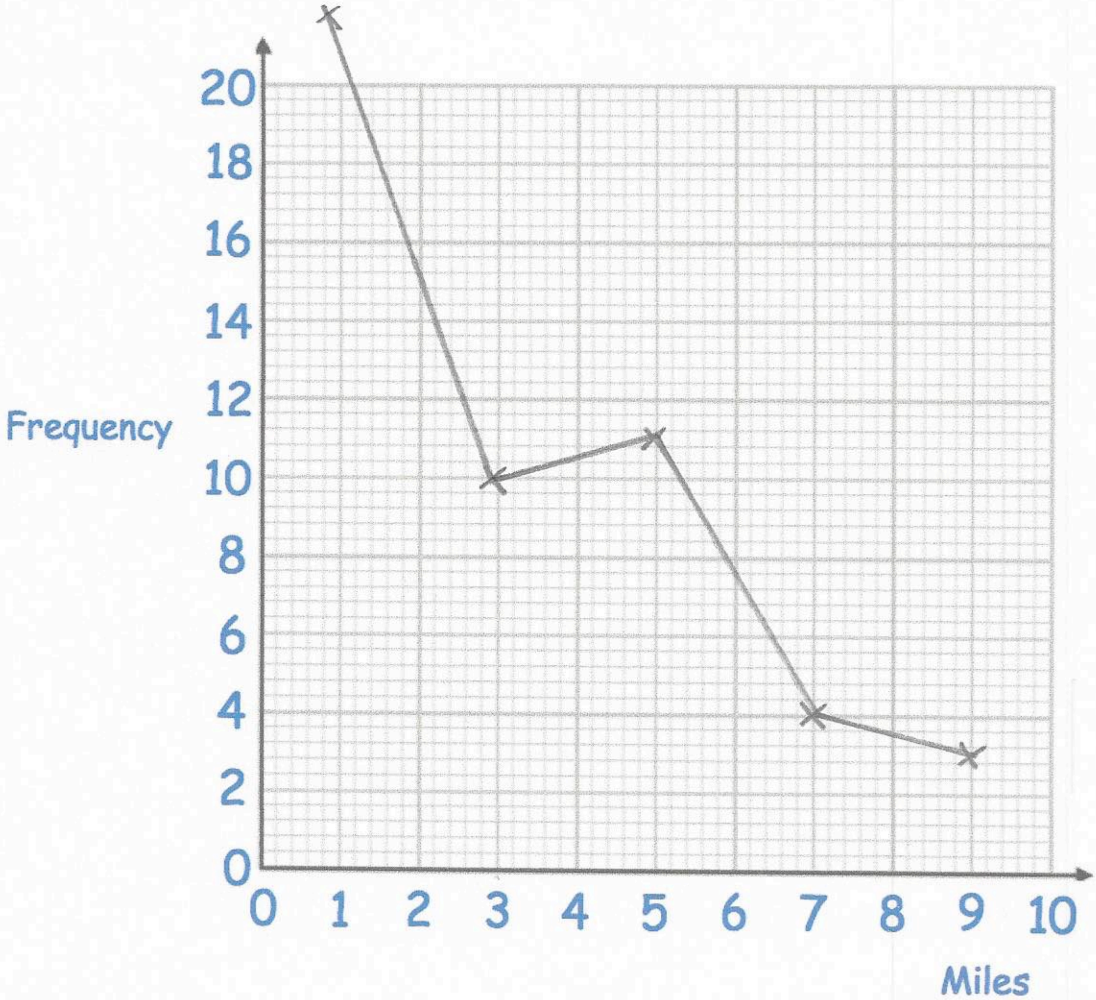
1. Time: 1 hour 30 minutes
2. The maximum mark for this paper is 80.
3. The marks for questions are shown in brackets
4. You may use tracing paper.

1. The table shows the distance travelled to school by 50 students.

Distance (miles)	Frequency
$0 < d \leq 2$	22
$2 < d \leq 4$	10
$4 < d \leq 6$	11
$6 < d \leq 8$	4
$8 < d \leq 10$	3

(a) Draw a frequency polygon to represent this data.

(2)



One student is chosen at random.

(b) Work out the probability that this student travels more than 6 miles to school.

7/50 ....

(1)

2. James has received two job offers.

A job in Milan which pays €55,000 a year.
A job in Boston which pays $64,000 a year.

The exchange rates were £1 = $1.42 and £1 = €1.25.

Which job offer has the highest salary?
Show working to explain your answer.

Milan €55,000 ÷ 1.25 = £44,000

Boston $64,000 ÷ 1.42 = £45070.42 ...

Boston pays (£1070.42) More

(3)

3. A liquid has mass of 10kg and a density of 1.18g/cm³.
Calculate the volume of the liquid.
Include suitable units.

D M V

$$V = \frac{\text{mass}}{\text{density}} = \frac{10{,}000}{1.18} = 8474.576$$

8474.6 cm³

(3)

4. At a football match, the ratio of women to men is 2:3.
The ratio of women to children is 7:6.

What percentage of the people at the rugby match are children?

women : men
2 : 3

×7 14 : 21

women : children
7 : 6

14 : 12

so children : women : men
12 : 14 : 21

so $\frac{12}{47}$ are children

= 25.5%

(3)

5. (a) Which number does not have a reciprocal?

0

(1)

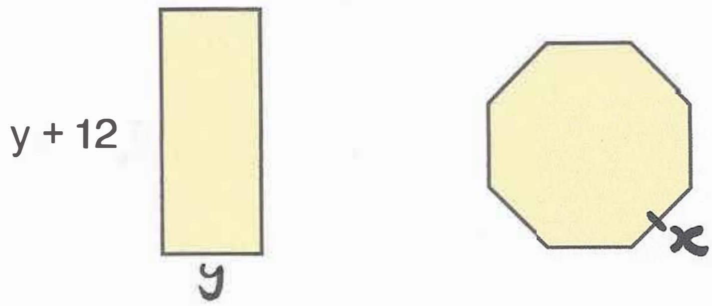
Olivia truncates a number, y, to one decimal place.
The result is 3.8

(b) Write down the error interval for y.

$3.8 \leq y < 3.9$

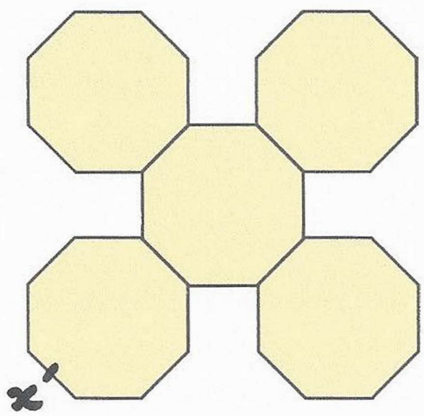
(2)

6. Here is a rectangle and a regular octagon.



The length of the rectangle is 12cm longer than the width of the rectangle.
The perimeter of the rectangle is equal to the perimeter of the octagon.

5 of the regular octagons are used to make a shape.



The perimeter of this shape is 132cm

Work out the area of the rectangle

$x = 132 \div 32 = 4.125$cm so perimeter of octagon $= 8 \times 4.125 = 33$cm

Perimeter of rectangle $= 4y + 24 = 33$ so $y = 2.25$

$\therefore$ width $= 2.25$
length $= 14.25$ area $= 2.25 \times 14.25$

32.0625 ....cm²

(6)

7. The distance of the moon to the Earth is 384,400 km.
The speed of light is 2.998×10^8 m/s.

Work out how long it will take light to travel from the moon to the Earth.
Include suitable units.

D
S T

$$\text{time} = \frac{\text{distance}}{\text{speed}}$$

$$= \frac{384{,}400{,}000}{2.998 \times 10^8}$$

$$= 1.28218\ldots$$

1.28 seconds
....
(3)

8. A spinner has four sections, each labelled A, B, C and D.
Susan and Helen spins the spinner a number of times.

The table shows some information.

	Number of spins	Number of B's	Relative frequency of spinning a B
Susan	20	8	0.4
Helen	120	42	0.35

$8 \div 20 = 0.4$

$120 \times 0.35 = 42$

(a) Complete the table.

(2)

Michael is going to spin the spinner twice.

(b) Use Helen's results to work out an estimate for the probability that spinner will not land on a B on either spin.

Helen : not B = 0.65

$0.65 \times 0.65 =$

0.4225

(2)

9. Harry invests £4000 in a savings account for 2 years at a rate of X % interest per annum.

At the end of the 2 years, Harry pays tax on the interest at a rate of 25%.
After paying tax he gets £121.20

Work out the value of X

£121.20 is 75% of the interest

$121.20 \div 75 \times 100 = £161.60$ (total interest)

After 2 years he has £4161.60

$4000 \times x^2 = 4161.60$

$\therefore x^2 = \frac{4161.60}{4000} = 1.0404$

$\therefore x = 1.02$

Interest rate = 2% $\quad \therefore \quad X = 2$

(4)

10. There are white chocolate, milk chocolate and dark chocolate sweets in a bag.
A sweet is taken at random from the bag.

The table shows the probability of getting each type of chocolate

Chocolate	dark	milk	white
Probability	$\frac{3}{20}$		$\frac{1}{3}$

(a) Work out the probability of getting a milk chocolate

$\frac{3}{20} + \frac{1}{3} = \frac{29}{60}$

$\frac{31}{60}$ ....

(1)

There are less than 500 chocolates in the bag.

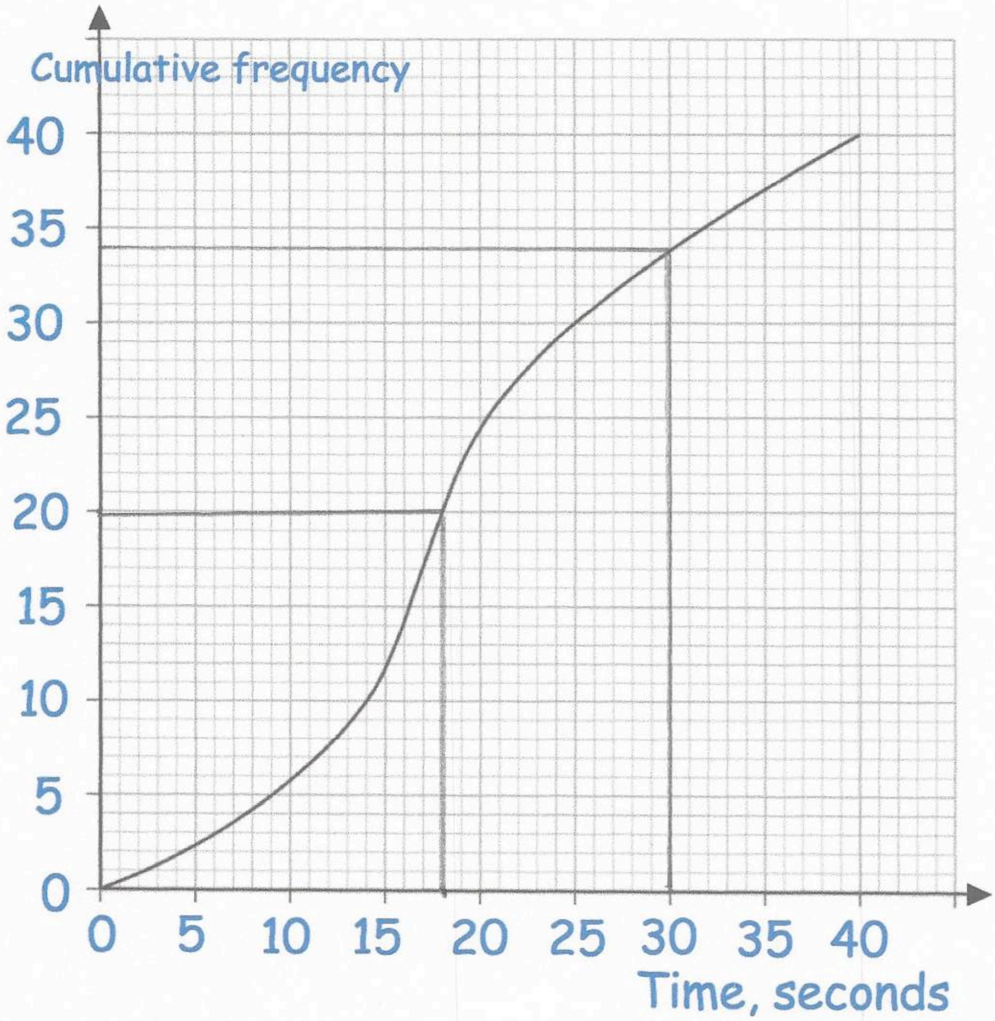
(b) What is the greatest possible number of chocolates in the bag?

must be a multiple of 60 (from part (a))

480 ....

(2)

11. The graph shows information about the time taken by 40 children to solve a puzzle.



(a) Use the graph to find an estimate for the median time taken.

18

.... **(1)**

(b) Show that less than 20% of the students took longer than 30 seconds.

from the graph 34 took less than 30, so 6 took more

20% of 40 = 8 6<8

....

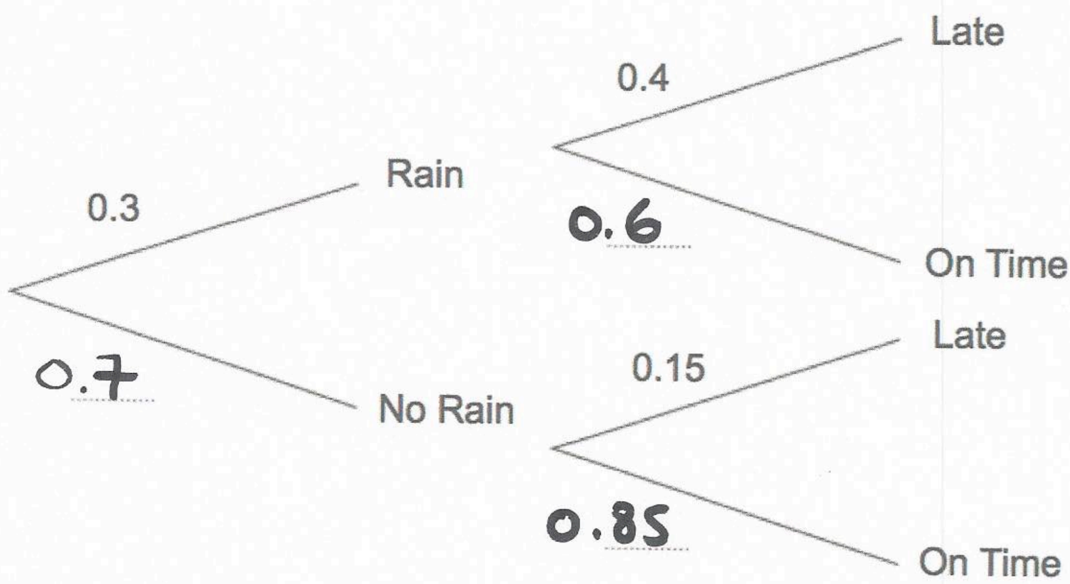
(2)

12. In a small village, one bus arrives a day.

The probability of rain in the village is 0.3.

If it rains, the probability of a bus being late is 0.4.
If it does not rain, the probability of a bus being late is 0.15.

(a) Complete the tree diagram



(1)

Over x consecutive days, the bus is late 27 times.

(b) Work out an estimate for x

$P(\text{late}) = 0.3 \times 0.4 + 0.7 \times 0.15 = \frac{9}{40}$

so the bus is late 9 out of every 40 days

so 27 out of every 120

$x \approx 120$

(4)

13. Solve the equation $2x^2 + 6x + 1 = 0$

Give your answers to two decimal places.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-6 \pm \sqrt{6^2 - 4 \times 2 \times 1}}{2 \times 2}$$

$$= \frac{-6 \pm \sqrt{28}}{4}$$

x = -0.18 or x = -2.82

(3)

14. The surface areas of two mathematically similar shapes are in the ratio 9 : 25

The volume of the smaller solid is 229.5cm³

Work out the volume of the larger solid

Area scale factor 9:25

length scale factor 3:5 (square root)

volume scale factor $3^3 : 5^3$

$= 27 : 125$

$\therefore$ vol of larger solid $= \frac{229.5}{27} \times 125 =$

1062.5 cm³

(3)

15. (a) Show that the equation $3x - x^3 = -11$ has a solution between $x = 2$ and $x = 3$

re-arranging $3x - x^3 + 11 = 0$

$x = 2$ LHS $= 3 \times 2 - 2^3 + 11 = 9$

$x = 3$ LHS $= 3 \times 3 - 3^3 + 11 = -7$

$\therefore$ Must be a solution between 2 & 3

(2)

(b) Show that the equation $3x - x^3 = -11$ can be rearranged to give

$$x = \sqrt[3]{3x + 11}$$

$3x - x^3 = -11$

$\Rightarrow 3x + 11 = x^3$

$\Rightarrow x^3 = 3x + 11$ So $x = \sqrt[3]{3x + 11}$

(2)

(c) Starting with $x_0 = 3$, use the iteration formula $x_{n+1} = \sqrt[3]{3x_n + 11}$ three times to find an estimate for the solution of $3x - x^3 = -11$

$x_0 = 3$

$x_1 = \sqrt[3]{3 \times x_0 + 11} = 2.7144\ldots$

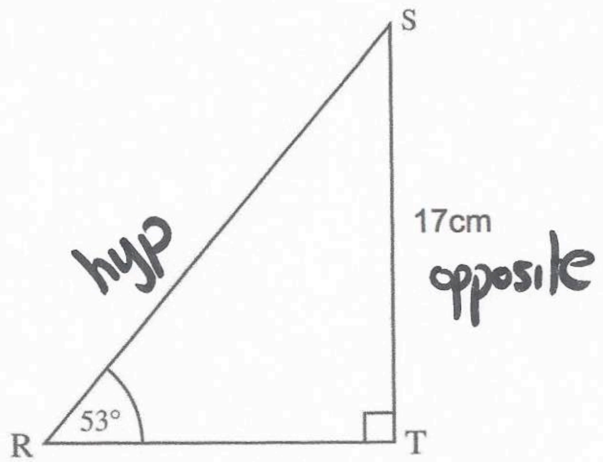
$x_2 = \sqrt[3]{3 \times x_1 + 11} = 2.675\ldots$

$x_3 = \sqrt[3]{3 \times x_2 + 11} = 2.6695\ldots$

$x \simeq 2.67$

(3)

16. Shown below is triangle RST.
Angle SRT is 53°, to the nearest degree.
ST is 17cm to the nearest centimetre.



Work out the upper bound for the length of RS.

$$RS = \frac{ST}{\sin 53}$$

ST : upper bound = 17.5

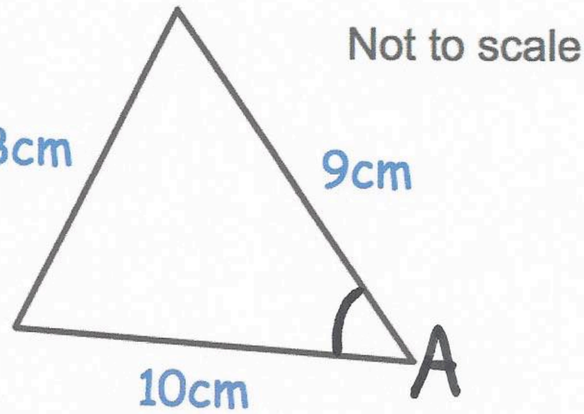
sin 53 : lower bound = sin 52.5

$$\therefore RS \text{ upper} = \frac{17.5}{\sin 52.5} = 22.058$$

22.058 cm

(3)

17.



Find the area of the triangle.

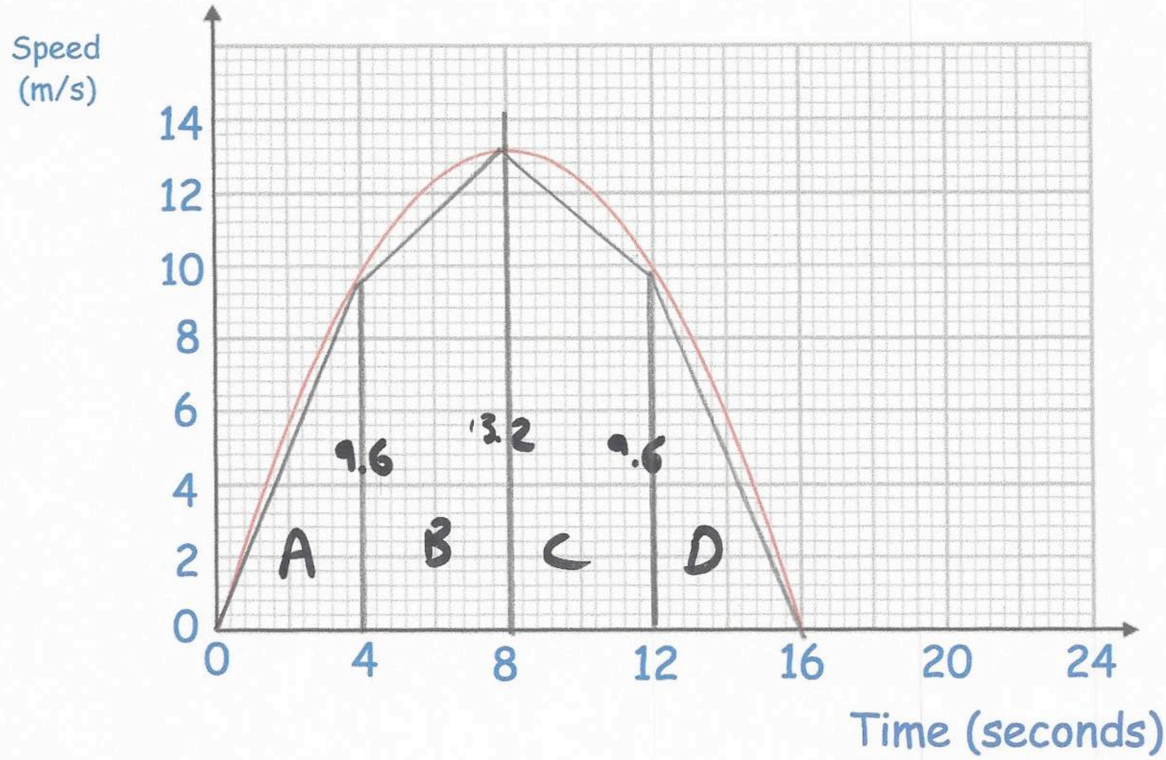
$$\cos A = \frac{10^2 + 9^2 - 8^2}{2 \times 9 \times 10} = \frac{13}{20} \quad \therefore A = 49.458\ldots$$

$$\text{area} = \frac{1}{2} \times 10 \times 9 \times \sin(49.458..) =$$

34.197 cm²

(5)

18. Here is a speed-time graph for bicycle.



(a) Work out an estimate for the distance the bicycle travelled in the first 8 seconds.
Use 4 strips of equal width

area A: $\frac{4 \times 9.6}{2} = 19.2 = D$

B: $\frac{9.6 + 13.2}{2} \times 4 = 45.6 = C$

total $= 19.2 \times 2 + 45.6 \times 2 =$ 129.6 m

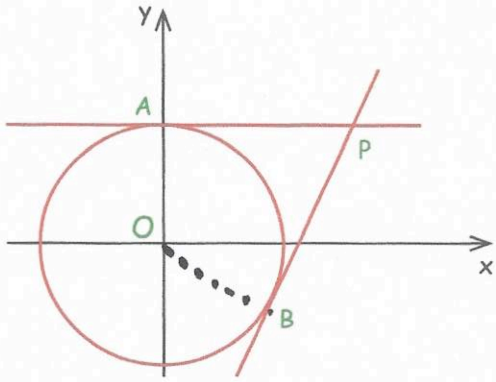
(3)

(b) Is your answer to (a) an underestimate or an overestimate of the actual distance the bicycle travelled?
Give a reason for your answer.

Underestimate since the lines are all clearly below the curve

(1)

19. The circle $x^2 + y^2 = 25$ has tangents at the points A and B.
The point A has coordinates (0, 5)
The point B has coordinates (3, −4)



The tangents meet at the point P.

Work out the coordinates of the point P.

radius OB has gradient $-\frac{4}{3}$

$\therefore$ tangent PB has gradient $\frac{3}{4}$ so $y = \frac{3}{4}x + c$

$x = 3$, $y = -4$ $\quad -4 = \frac{3}{4} \times 3 + c \quad \therefore c = -\frac{25}{4}$

So PB has equation $y = \frac{3}{4}x - \frac{25}{4}$

AP is the line $y = 5$

So $\frac{3}{4}x - \frac{25}{4} = 5$

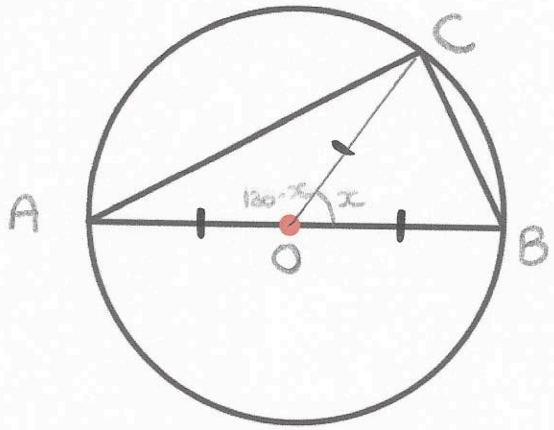
$3x - 25 = 20$

$3x = 45 \quad x = 15$

(15, 5)

(5)

20.



Prove that the angle in a semi-circle is always 90°

Let $C\hat{O}B = x$

$\therefore$ in triangle COB, angle $B\hat{C}O = \frac{180 - x}{2} = 90 - \frac{1}{2}x$

angle $C\hat{O}A = 180°$ (angles on a straight line add to 180°)

$\therefore$ in triangle COA, angle $O\hat{C}A = \frac{1}{2}x$

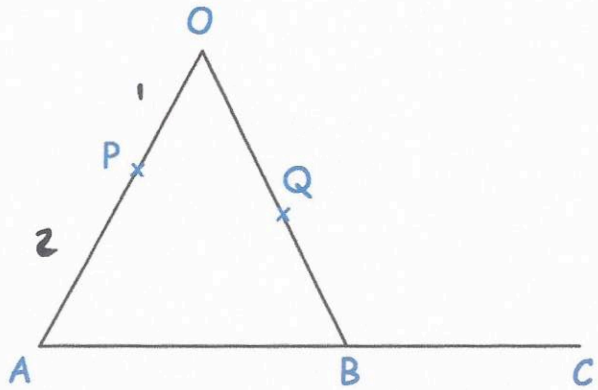
(since both triangles are isosceles, so angles $O\hat{C}A = O\hat{A}C$ and $O\hat{B}C = O\hat{C}B$)

$\therefore$ angle $A\hat{C}B = B\hat{C}O + O\hat{C}A$

$= 90 - \frac{1}{2}x + \frac{1}{2}x = 90°$

(3)

21.



AOB is a triangle.
P is a point on AO.

$\overrightarrow{AB} = 2a$ $\overrightarrow{AO} = 6b$ AP:PO = 2:1

(a) Find the vector $\overrightarrow{OB}$ in terms of **a** and **b**

$-6\underset{\sim}{b} + 2\underset{\sim}{a}$

(1)

Q is the midpoint of OB.
B is the midpoint of AC.

Show PQC is a straight line.

$\overrightarrow{PQ} = \overrightarrow{PO} + \overrightarrow{OQ}$
$= \frac{1}{3}\overrightarrow{AO} + \frac{1}{2}\overrightarrow{OB}$
$= 2\underset{\sim}{b} + \frac{1}{2}(-6\underset{\sim}{b} + 2\underset{\sim}{a})$
$= 2\underset{\sim}{b} - 3\underset{\sim}{b} + \underset{\sim}{a}$
$= \underset{\sim}{a} - \underset{\sim}{b}$

$\overrightarrow{QC} = \overrightarrow{QB} + \overrightarrow{BC}$
$= \frac{1}{2}\overrightarrow{OB} + \overrightarrow{AB}$
$= -3\underset{\sim}{b} + \underset{\sim}{a} + 2\underset{\sim}{a}$
$= 3\underset{\sim}{a} - 3\underset{\sim}{b}$
$= 3\overrightarrow{PQ}$

(3)

$\therefore$ PQ & QC are parallel
so PQC is a straight line