Ed - H | Nov '24 | P3 - Calc

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 The table shows information about the times, in minutes, 100 people took to complete a bike race.

mid

130

150

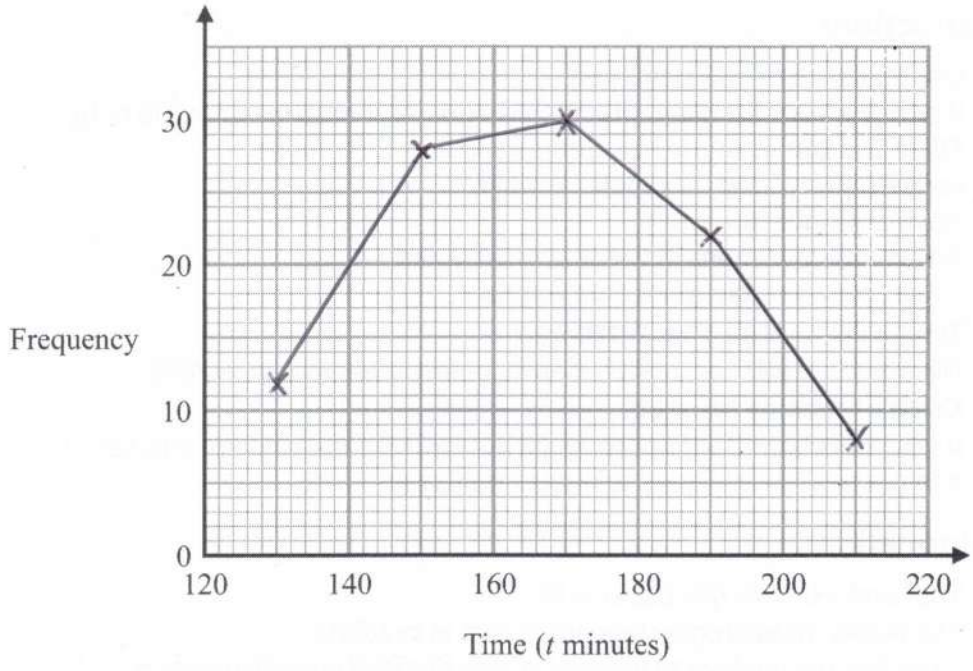
170

190

210

Time (t minutes)	Frequency
$120 \leqslant t < 140$	12
$140 \leqslant t < 160$	28
$160 \leqslant t < 180$	30
$180 \leqslant t < 200$	22
$200 \leqslant t < 220$	8

On the grid below, draw a frequency polygon for this information.



(Total for Question 1 is 2 marks)

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2 (a) Write 3.402×10^5 as an ordinary number.

340200

(1)

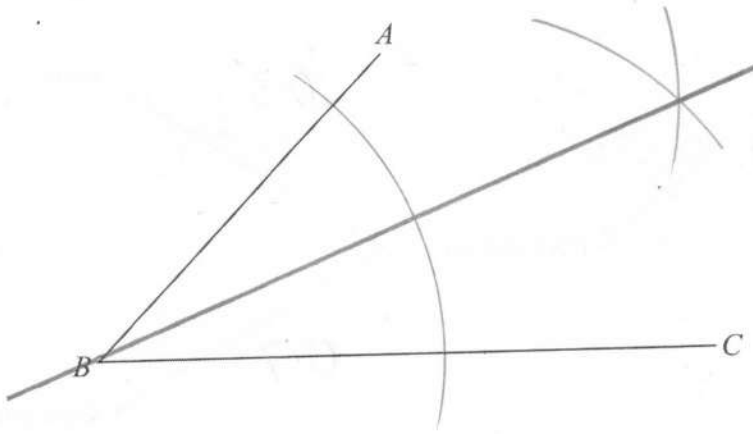
(b) Write 0.8026 in standard form.

8.026×10^{-1}

(1)

(Total for Question 2 is 2 marks)

3 Use ruler and compasses to construct the bisector of angle *ABC*.
You must show your construction lines.



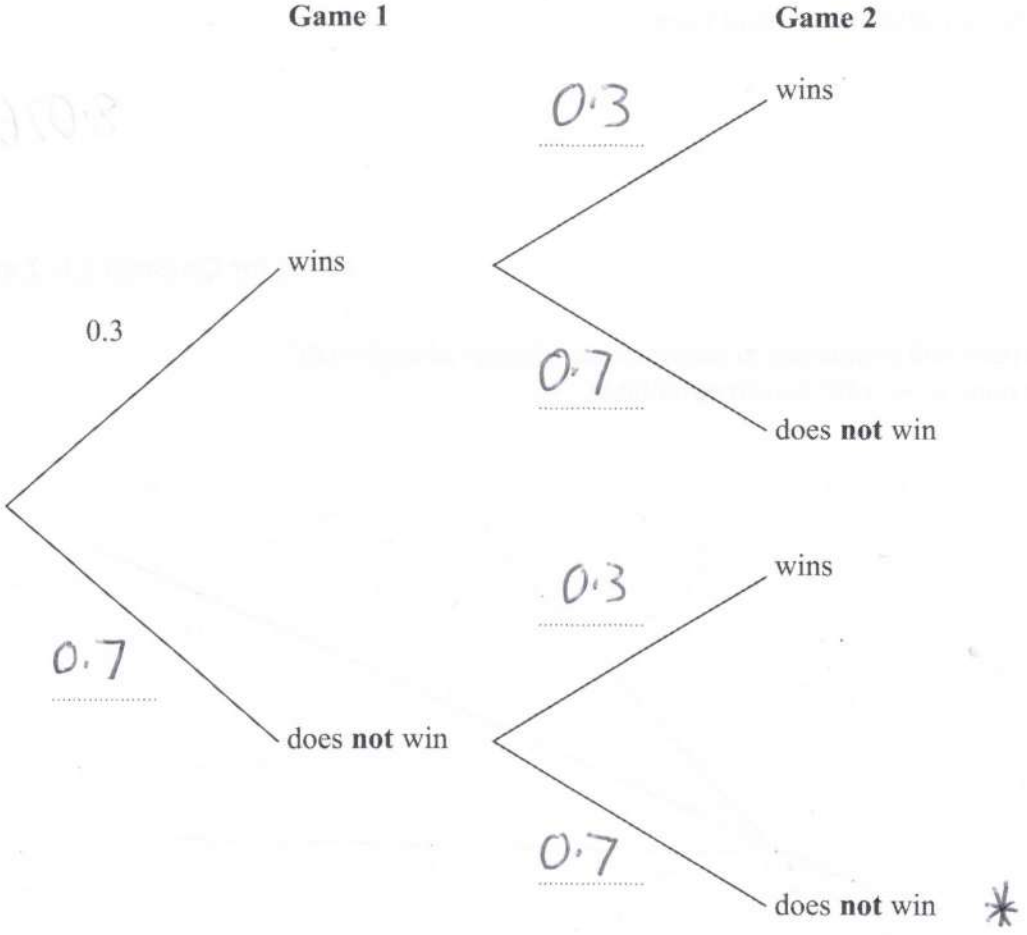
(Total for Question 3 is 2 marks)

4 Dan is playing cards.

The probability that he will win a game of cards is 0.3

Dan plays two games of cards.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Dan does **not** win either game.

$0.7 \times 0.7 = 0.49$

(2)

(Total for Question 4 is 4 marks)

5 Robyn buys a total of 240 pens and pencils, where

number of pens : number of pencils = 3 : 5

Robyn pays 9p for each pen.
She sells each pen for 11p. 2p

Robyn pays 6p for each pencil.
She sells each pencil for 10p. 4p

Robyn sells all of the pens and pencils.

Work out Robyn's percentage profit.
Give your answer correct to 1 decimal place.
You must show all your working.

Pens profit

$= \frac{3}{8} \times 240 \times 2p$

$= 180p$

Pencils profit

$= \frac{5}{8} \times 240 \times 4p$

$= 600p$

Total = 780p

Cost = $(90 \times 9) + (150 \times 6)$

$= 1710p$

% profit = $\frac{780}{1710} \times 100 = 45.61...$

45.6 %

(Total for Question 5 is 5 marks)

6 The stem and leaf diagram shows the test scores of 23 students from School **A**.

3	0
4	1 2 4 4 5 7
5	3 4 4 6 7 8 8 9
6	0 8 8 9 9
7	1 3 9

Key:
3 | 0 represents 30

23 students from School **B** did the same test.

Their median score was 56
The range of their scores was 47

Compare the distribution of the test scores of the students from School **A** with the distribution of the test scores of the students from School **B**.

School A median = 57 > 56 so on average school A did better

Range of A = 79 - 30 = 49 > 47 so school A's results were more varied

(Total for Question 6 is 4 marks)

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7 Jana used her calculator to find the value of a number t.
The answer on her calculator began 10.2

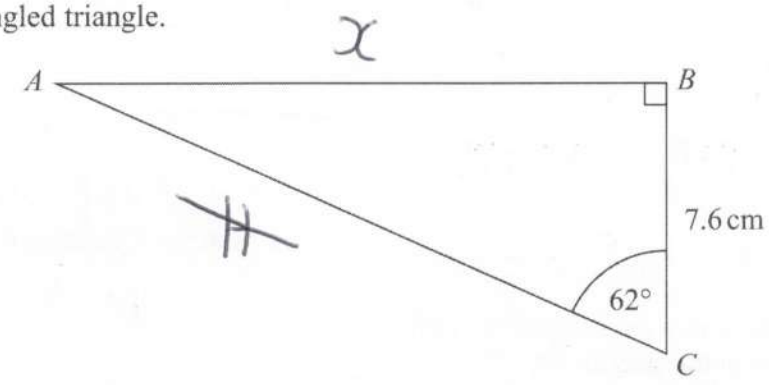
Complete the error interval for t.

Truncation!
not bounds

10·2 $\leqslant t <$ 10·29/10·3

(Total for Question 7 is 2 marks)

8 ABC is a right-angled triangle.



A

Calculate the length of AB.
Give your answer correct to 1 decimal place.

T O A

$x = \tan(62) \times 7.6$

$= 14.29...$

14.3 cm

(Total for Question 8 is 2 marks)

9 (a) Simplify fully $2x^3y^5 \times 7x^2y$

$14x^5y^6$

(2)

(b) Simplify $(m^2)^{-3}$

m^{-6}

(1)

(Total for Question 9 is 3 marks)

10 In a sale, the normal prices are reduced by 15%
Amina buys a dress in the sale for £46.75

Work out the normal price of the dress.

$x \times 0.85 = 46.75$

$x = \dfrac{46.75}{0.85}$

£ 55

(Total for Question 10 is 2 marks)

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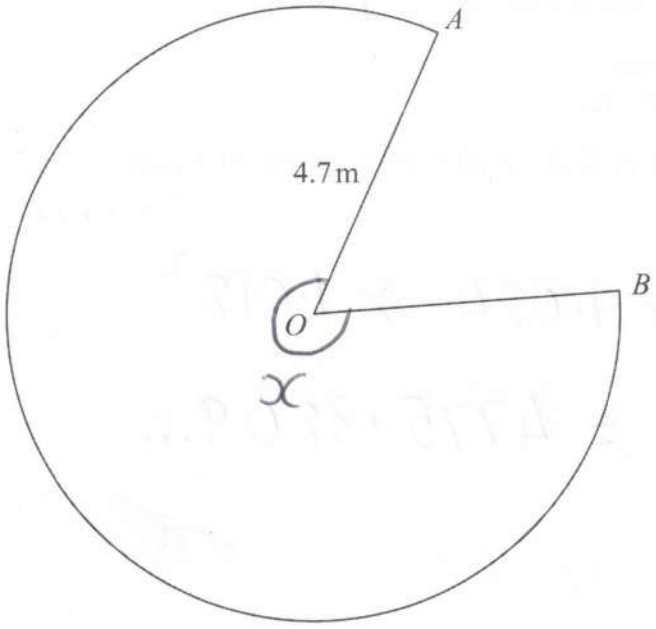
11 OAB is a sector of a circle with centre O and radius 4.7 m.



The sector has a perimeter of 34.3 m.

Find the size of the reflex angle AOB.
Give your answer correct to the nearest degree.

arc length = $34.3 - (2 \times 4.7) = 24.9$

$2 \times \pi \times 4.7 \times \frac{x}{360} = 24.9$

$x = 303.5...$

304 °

(Total for Question 11 is 3 marks)

12 Rudi invests £4500 in a savings account.

He gets compound interest at a rate of

2.4% for the first year
1.8% for each extra year.

(a) Work out the value of Rudi's investment at the end of 3 years.

$4500 \times 1.024 \times 1.018^2$

$= 4775.3809...$

£ 4775.38

(3)

Bruna buys a car for £7500

The value of the car depreciates by x% each year.
At the end of 2 years the value of the car is £4107

(b) Work out the value of x.

$7500 \times y^2 = 4107$

$y = \sqrt{0.5476}$

$y = 0.74$

$x =$ 26

(3)

(Total for Question 12 is 6 marks)

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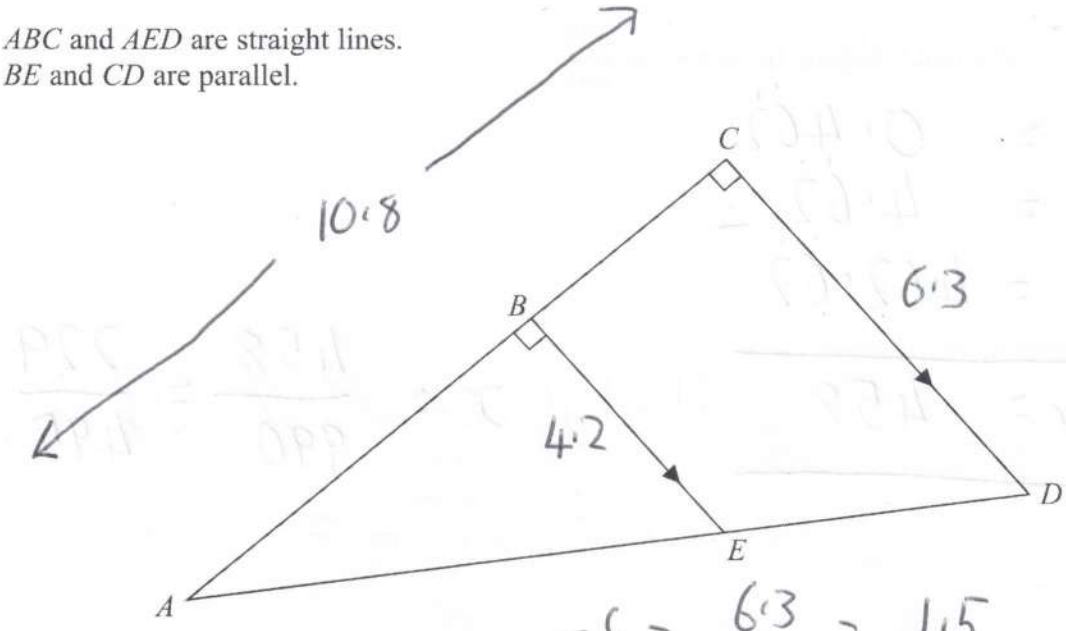
13 *ABC* and *AED* are straight lines.
BE and *CD* are parallel.



$sf = \frac{6.3}{4.2} = 1.5$

BE = 4.2 cm
CD = 6.3 cm
AC = 10.8 cm

Work out the area of trapezium *BCDE*.

$AB = 10.8 \div 1.5 = 7.2$

$BC = 10.8 - 7.2$

$= 3.6$ = height of trapezium

$\text{Area} = \frac{1}{2}(4.2 + 6.3) \times 3.6$

18·9

..... cm^2

(Total for Question 13 is 3 marks)

14 Prove algebraically that $0.4\dot{6}\dot{2}$ can be written as $\frac{229}{495}$

$$x = 0.4\dot{6}\dot{2}$$
$$10x = 4.\dot{6}\dot{2}$$
$$1000x = 462.\dot{6}\dot{2}$$
$$990x = 458$$

$$x = \frac{458}{990} = \frac{229}{495}$$

(Total for Question 14 is 3 marks)

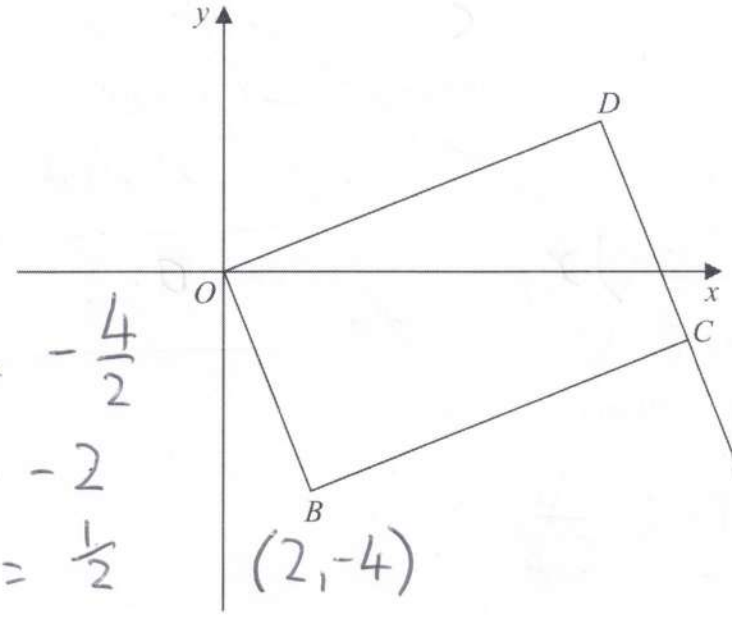
15 Make p the subject of the formula $t = \frac{2(2p-3)}{5-2p}$

$$t(5-2p) = 4p - 6$$
$$5t - 2tp = 4p - 6$$
$$5t + 6 = 4p + 2tp$$
$$5t + 6 = p(4 + 2t)$$

$$p = \frac{5t+6}{4+2t}$$

(Total for Question 15 is 4 marks)

16 *OBCD* is a rectangle.
DCE is a straight line.



$m_{OB} = -\frac{4}{2}$

$= -2$

and $m_{BC} = \frac{1}{2}$

(x, y)

(2, −4)

(12, −6.5)

B has coordinates (2, −4)
E has coordinates (12, −6.5)

Work out the coordinates of *D*.
You must show all your working.

$m_{BC} = \frac{y+4}{x-2} = \frac{1}{2} \Rightarrow 2y+8 = x-2$

$2y+10 = x$ ①

$m_{CE} = \frac{y+6.5}{x-12} = -2 \Rightarrow y+6.5 = -2x+24$

$-y+17.5 = 2x$ ②

① into ② $\Rightarrow -y+17.5 = 4y+20$

$-2.5 = 5y$

$y = -0.5$, $x = 2(-0.5)+10 = 9$

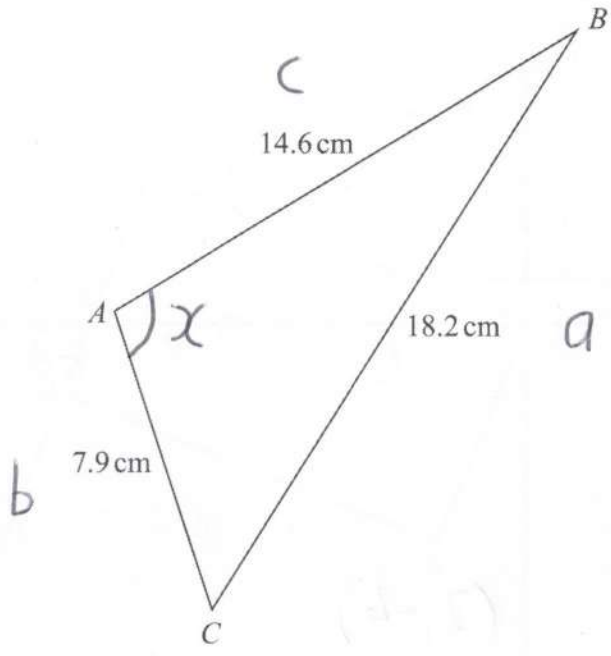
$\overrightarrow{BC} = \begin{bmatrix} 7 \\ 3.5 \end{bmatrix}$

hence $\overrightarrow{OD}$ = same

(7, 3.5)

(Total for Question 16 is 5 marks)

17 Here is triangle ABC.



Work out the area of triangle ABC.
Give your answer correct to 3 significant figures.

$18.2^2 = 7.9^2 + 14.6^2 - 2 \times 7.9 \times 14.6 \times \cos x$

$\cos x = \frac{55.67}{-230.68}$

$x = \cos^{-1}(-0.2413\ldots) = 103.965\ldots^\circ$

Area $= \frac{1}{2} \times 7.9 \times 14.6 \times$ sin (ANS)

$= 55.96\ldots$

56.0

..... cm^2

(Total for Question 17 is 4 marks)

18 Maria wants to find an estimate for the number of frogs in a lake.

On Saturday she catches 40 of the frogs.
She puts a tag on each frog and releases them.

Capture / recapture

On Monday she catches 55 of the frogs.
11 of the frogs have tags.

(a) Work out an estimate for the total number of frogs in the lake.
You must show all your working.

$\frac{40}{N} = \frac{11}{55}$

$2200 = 11N$

$N = \frac{2200}{11}$

200

(3)

(b) State one assumption you have made.

All the tags stay attached/
The frogs recaptured are representative of the overall population

(1)

(Total for Question 18 is 4 marks)

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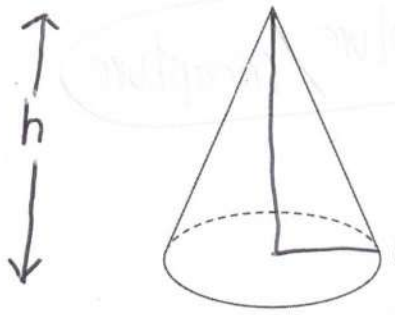
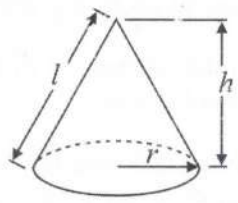
19 The diagram shows a cone.



Curved surface area of cone $= \pi rl$



The radius of the base of the cone is $\frac{3}{4}$ of the height of the cone.

The total surface area of the cone is $54\pi\,\text{cm}^2$

Work out the height of the cone.

Slant $= \sqrt{\left(\frac{3h}{4}\right)^2 + h^2} = \sqrt{\frac{9h^2}{16} + h^2} = \sqrt{\frac{25h^2}{16}} = \frac{5}{4}h$

Total Surface Area $= \pi \times \frac{3}{4}h \times \frac{5h}{4} + \pi \times \left(\frac{3h}{4}\right)^2 = 54\pi$

$= \frac{15h^2}{16} + \frac{9h^2}{16} = 54$

$= 24h^2 = 864$

$h^2 = 36$

$h = \sqrt{36}$

6

..... cm

(Total for Question 19 is 4 marks)

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20 Solve the simultaneous equations

$$y^2 = 3x^2 + 4$$
$$y + 2x = 7$$

Give your solutions correct to 3 significant figures.

$y = 7 - 2x$

$y^2 = (7-2x)^2$

$(7-2x)^2 = 3x^2 + 4$

$49 + 4x^2 - 14x - 14x = 3x^2 + 4$

$x^2 - 28x + 45 = 0$

$$x = \frac{28 \pm \sqrt{784 - 180}}{2}$$

$x = 26.2882...$

$y = 7 - (2 \times 26.2882)$

$= -45.57...$

$x = 1.7117...$

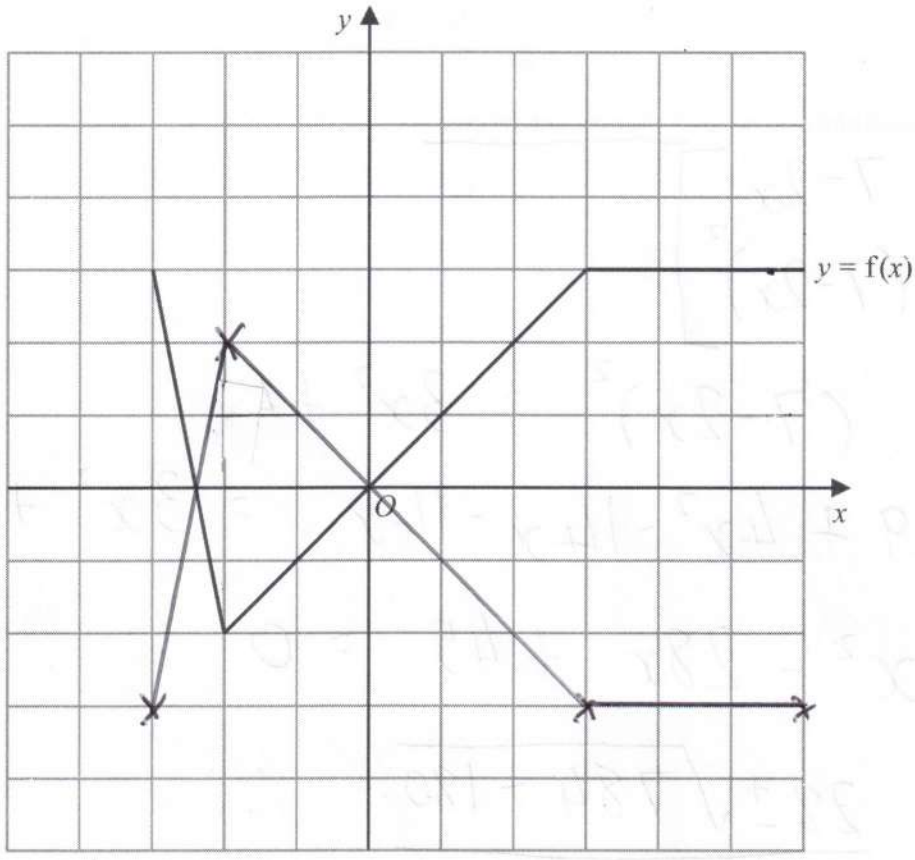
$y = 7 - (2 \times 1.7117)$

$= 3.5764...$

$x = 26.3, y = -45.6 / x = 1.71, y = 3.58$

(Total for Question 20 is 4 marks)

21 Here is the graph of $y = f(x)$



(a) On the grid, draw the graph of $y = -f(x)$

(1)

f(x) × -1

= reflection in x-axis

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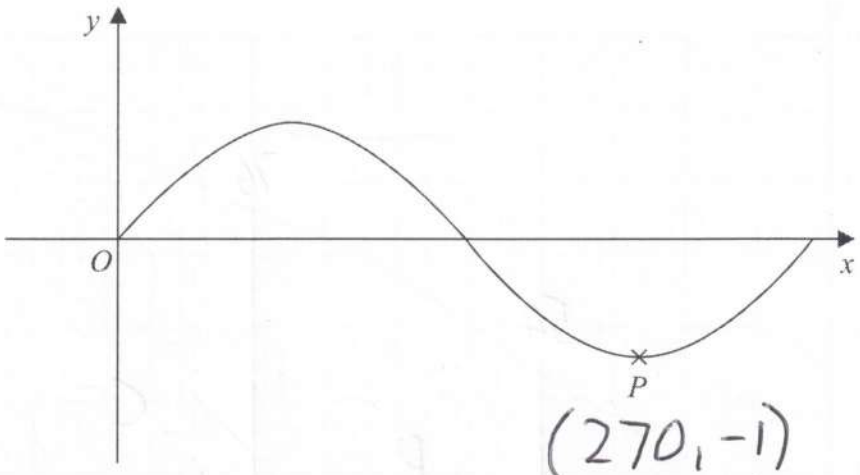
Here is a sketch of the graph of $y = \sin x°$



(270, -1)

The point marked P is a turning point on the graph.

The graph of $y = \sin x°$ is translated to give the graph of $y = \sin(x + 180)° + 4$

Following the translation the point P, shown on the graph above, moves to point R.

(b) Find the coordinates of R.

$\begin{bmatrix} -180 \\ 4 \end{bmatrix}$

+4

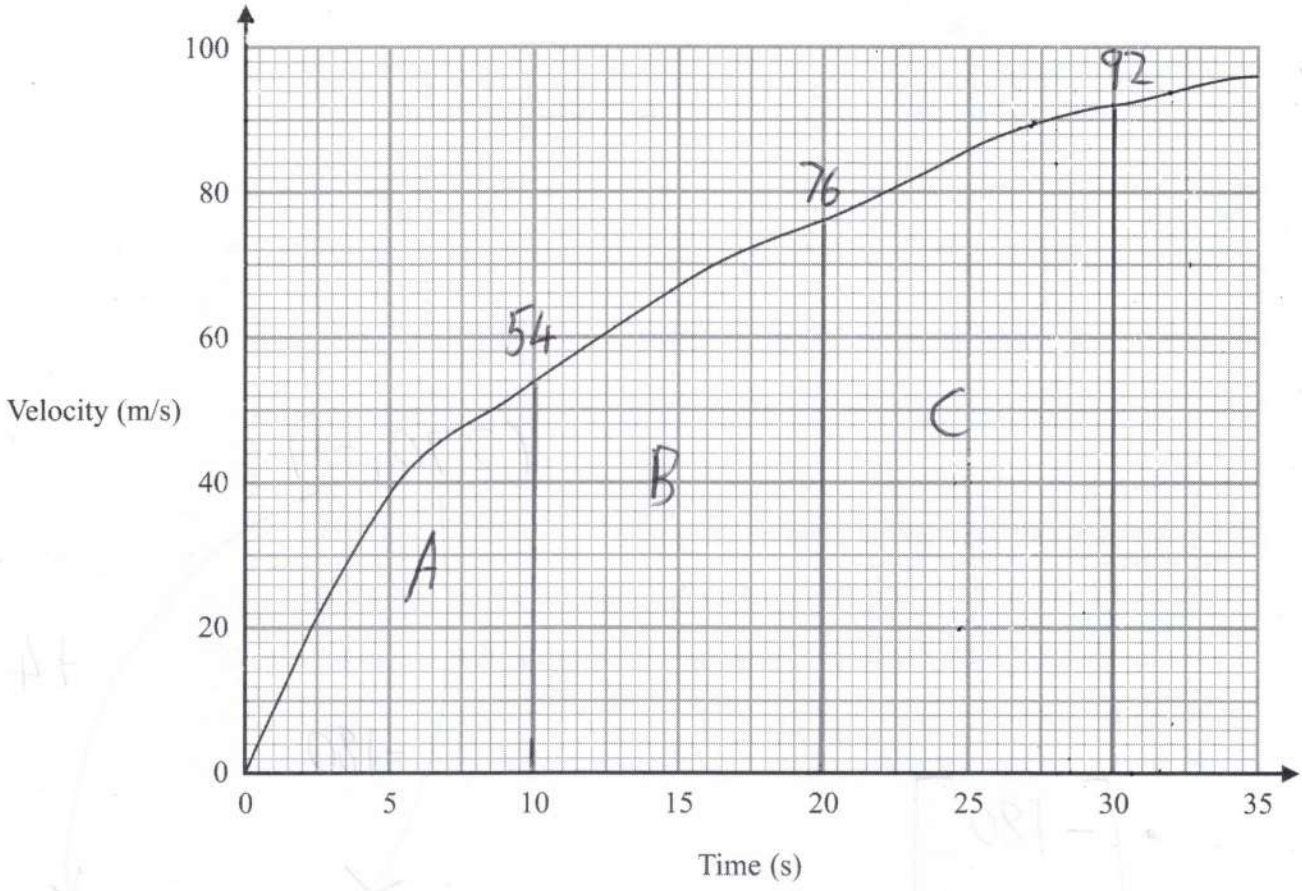
-180

(90 , 3)

(3)

(Total for Question 21 is 4 marks)

22 Here is a velocity-time graph for an aeroplane.



Work out an estimate for the distance the aeroplane travelled in the first 30 seconds.
Use 3 strips of equal width.

$A = \frac{1}{2} \times 10 \times 54 = 270$

$B = \frac{1}{2}(54+76) \times 10 = 650$

$C = \frac{1}{2}(76+92) \times 10 = 840$

$270 + 840 + 650$

1760

..... m

(Total for Question 22 is 3 marks)

23 Sketch the graph of

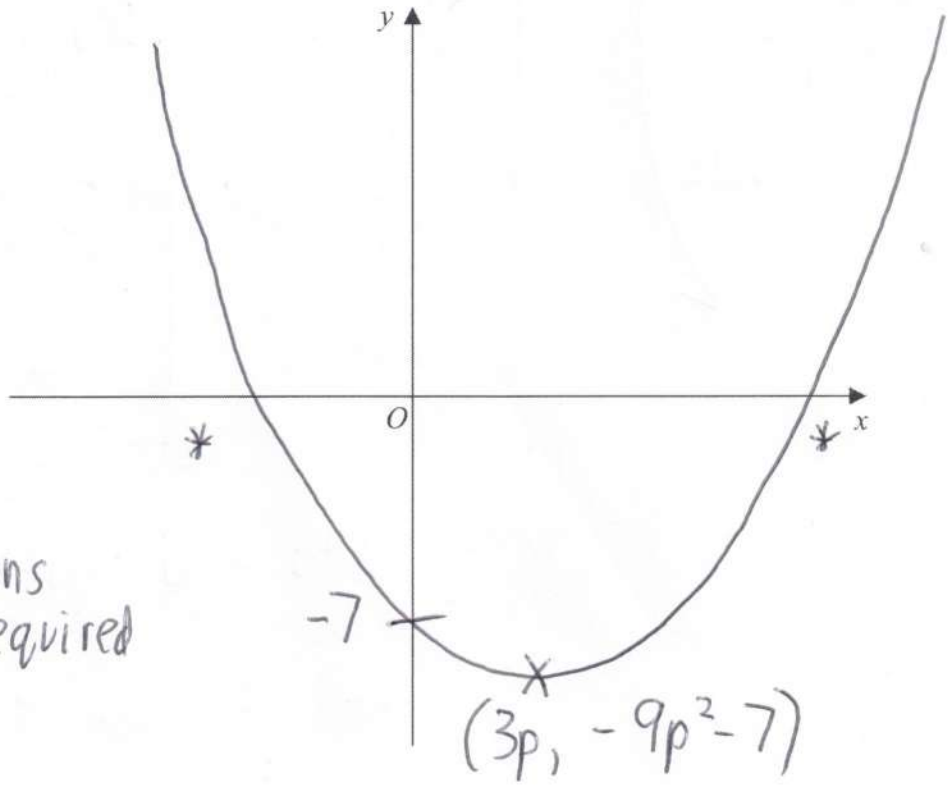
$$y = x^2 - 6px - 7 \quad \text{where} \quad p > 0$$

$C = -7$

showing the coordinates of the turning point, in terms of p, and the coordinates of the intercept with the y-axis.
You must show all your working.

$y = (x - 3p)^2 - 9p^2 - 7$

$V(3p, -9p^2 - 7)$



* solutions not required

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS