1 The height of a building is 310 metres, correct to the nearest metre.

Complete the error interval for the height of the building.

$1 \text{ m} \div 2 = 0.5 \text{ m}$

310

-0.5 U   L $+0.5$

309.5   310.5

<u>**309.5**</u> m   length <   <u>**310.5**</u> m

(Total for Question 1 is 2 marks)

2 Work out $(3.12 \times 10^{-6}) \div (2.5 \times 10^{-4})$

Give your answer in standard form.

0.01248

$= 1.248 \times 10^{-2}$

<u>1.248×10^{-2}</u>

(Total for Question 2 is 2 marks)

3 Three buses, bus A, bus B and bus C, all use the same bus stop.

Bus A runs every 10 minutes.
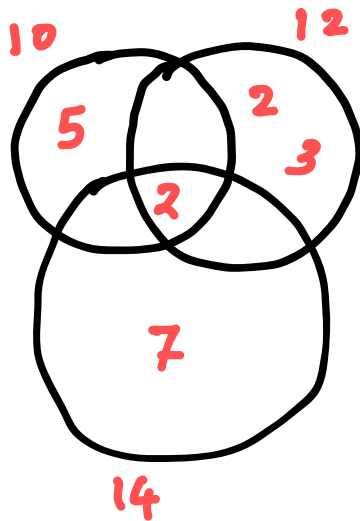Bus B runs every 12 minutes.
Bus C runs every 14 minutes.

$10 = 2 \times 5$
$12 = 2 \times 2 \times 3$
$14 = 2 \times 7$

All three buses are at the bus stop at 11 am.

What time will all three buses next be at the bus stop.

10   12

5   2
   2   3

7

14

$LCM = 2 \times 2 \times 3 \times 5 \times 7$
$= 420 \text{ mins}$

$\dfrac{420}{60} = 7 \text{ hours}$

_____6 PM_____

(Total for Question 3 is 3 marks)

4 The table gives information about the times taken, in seconds, by 20 students to run a race.

Time (t seconds)	mid point x	Frequency f	xf
$20 < t \leq 25$	22.5	2	45
$25 < t \leq 30$	27.5	10	275
$30 < t \leq 35$	32.5	5	162.5
$35 < t \leq 45$	40	3	120
		20	602.5

Work out an estimate for the mean time.

$\dfrac{\Sigma fx}{\Sigma f} = \dfrac{602.5}{20} = 30.125$

$= 30.1 \ (3 \ S.f.)$

_____30.1_____ seconds

(Total for Question 4 is 3 marks)

5 $ABCD$ is a trapezium.
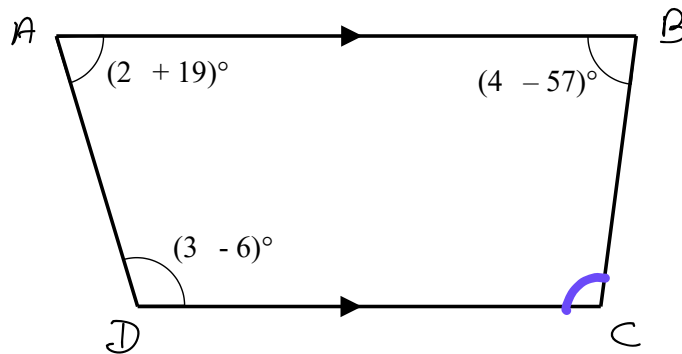
AB is parallel to DC
Find the size of angle BCD.

$$2x + 19 + 3x - 6 = 180° \quad (\because \text{Co-interior angles add to } 180°)$$

$$5x + 13 = 180$$

$$5x = 167$$

$$x = 33.4$$

$$\angle ABC = 4x - 57$$
$$= 4(33.4) - 57$$
$$= 76.6°$$

$$\angle BCD = 180 - 76.6°$$
$$= 103.4°$$

$$\underline{103.4}°$$

(Total for Question 5 is 4 marks)

6   (a) Complete the table of values for $y = 7 + 2x - x^2$

x	-2	-1	0	1	2	3	4
y	-1	4	7	8	7	4	-1

(2)

(b) On the grid, draw the graph of $y = 7 + 2x - x^2$ for values of   from –2 to 4
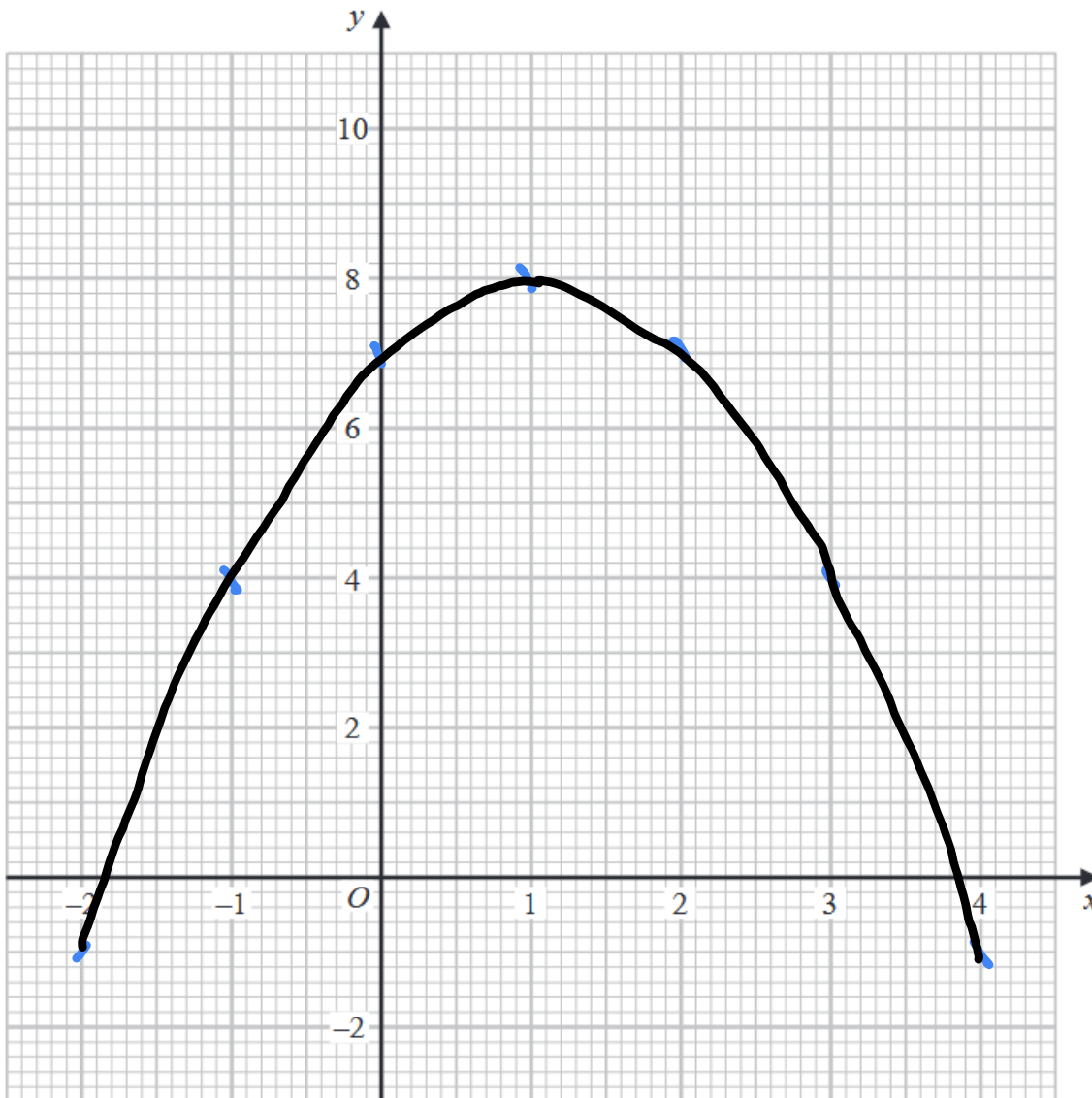
(c) Use your graph to find estimates of the solutions of the equation $7 + 2x - x^2 = 0$

-1.8 & 3.8

x -1.9 & 3.9

(2)

(Total for Question 6 is 6 marks)

7 Josh drove 39 miles from Luton to Cambridge.
He then drove 63 miles from Cambridge to Norwich.

Josh's average speed from Luton to Cambridge was 32 miles per hour
Josh took 80 minutes to drive from Cambridge to Norwich.

Work out Josh's average speed for his total drive from Luton to Norwich.

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

$$t = \frac{d}{s}$$

L → C

$$Time = \frac{39}{32} = 1.21875 \text{ hours}$$

C → N

$$Time = 80 \text{ mins}$$

$$= \frac{80}{60} = \frac{4}{3} = 1.\dot{3} \text{ hours}$$

$$Total \text{ time} = \frac{39}{32} + \frac{4}{3} = 2.552083....$$

$$Avg. \ S = \frac{Total \ distance}{Total \ time}$$

$$= \frac{39 + 63}{2.55208...} = 39.96734...$$

40.0 _____ miles per hour

(Total for Question 7 is 4 marks)

8 Milly invests £2000 in a savings account for 4 years.
She gets 3.9% per year compound interest.

Work out how much money Milly will have in her savings account at the end of 4 years.
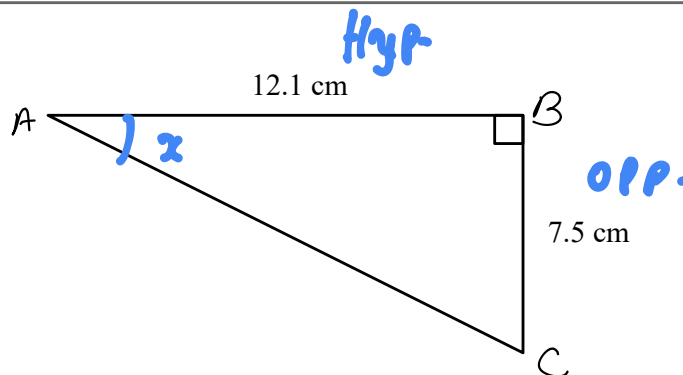Give your answer correct to the nearest pound.

$$2000 \times 1.039^4$$

$$= 2330.73$$

3.9% increase

103.9%

$= 1.039$

£ **2331**

(Total for Question 8 is 3 marks)

9

Hyp

12.1 cm

A $\quad$ x $\qquad$ B

Opp.

7.5 cm

C

Work out the size of angle BAC
Give your answer correct to 3 significant figures.

$$\tan x = \frac{7.5}{12.1}$$

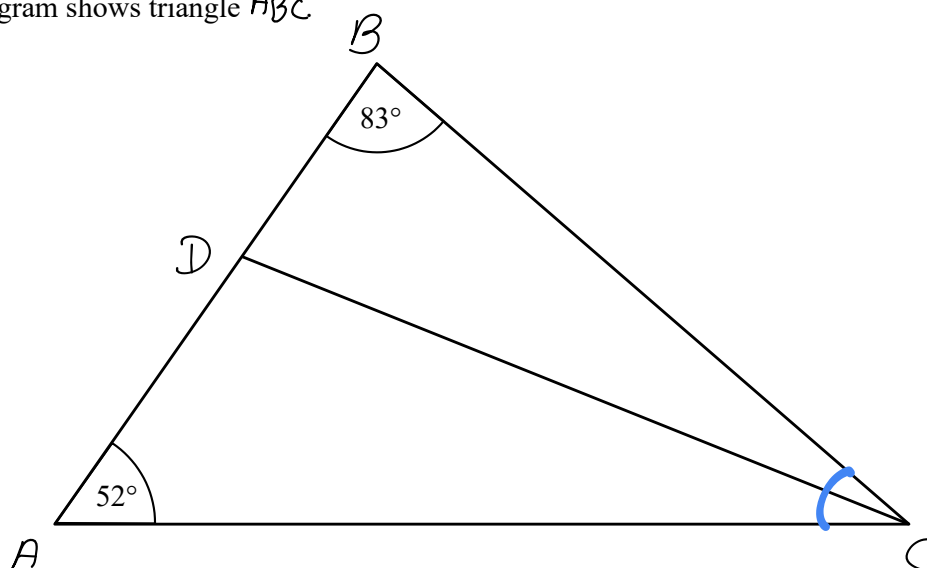$$x = \tan^{-1}\left(\frac{7.5}{12.1}\right)$$

$$x = 31.8°$$

SOH $\quad$ CAH $\quad$ TOA

$$\tan x = \frac{opp}{hyp.}$$

31.8 °

(Total for Question 9 is 2 marks)

10   The diagram shows triangle ABC

ADB is a straight line.

the size of angle BCD : the size of angle ACD = 2 : 3

Work out the size of angle ADC .

$\angle BCA = (180 - (52 + 83) = 45$

$2 + 3 = 5$ Parts

$45 \div 5 = 9$

$\angle BCD : \angle ACD = 2 : 3 = 18 : 27$

In $\triangle ACD$,

$\angle ADC = 180° - (52° + 27°)$

$= 101°$

<u>101</u>   °

(Total for Question 10 is 4 marks)

11 A company has 9 employees available to complete a job.
It is known that 7 employees can complete the job in 12 days.

Davina says that the 9 employees will be able to complete the job in less than 10 days.
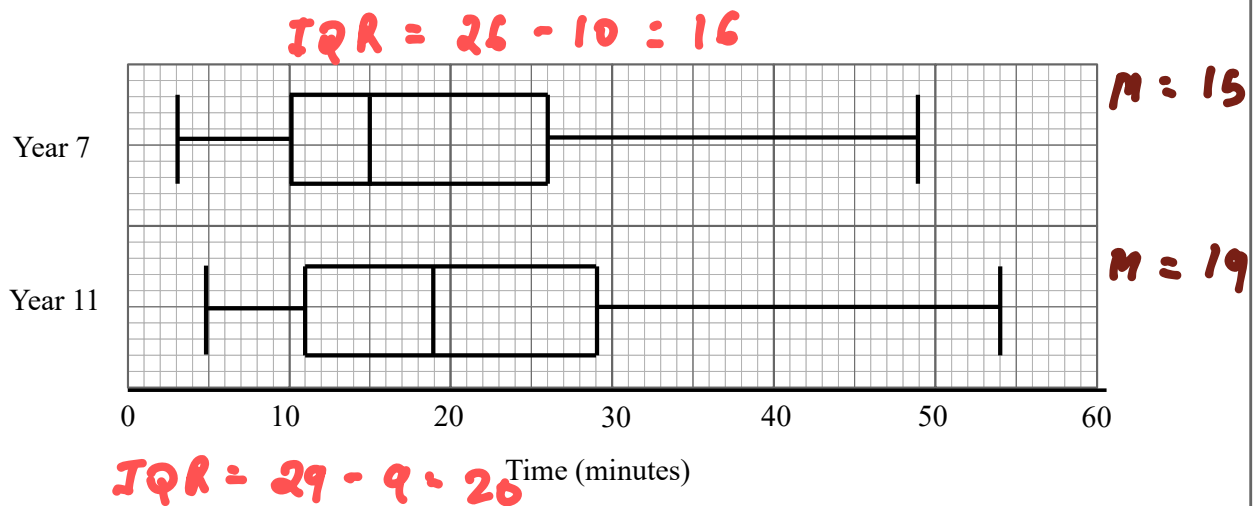
Is Davina correct?
You must show all your working.

$$7 \times 12 = 84$$

$$84 \div 9 = 9.\dot{3} \text{ days}$$

$$9.\dot{3} < \underline{10} \qquad \underline{\underline{Yes}}$$

(Total for Question 11 is 3 marks)

12 The box plots show the time it took year 7 and year 11 students to travel to school on one day.

$IQR = 26 - 10 = 16$

$M = 15$

$M = 19$

Year 7

Year 11

$IQR = 29 - 9 = 20$

Time (minutes)

Compare the distribution of the times it took the year 7 and year 11 students to travel to school.

- The median time taken for Y7 is lower, Year 7 take less time to travel.
- The IQR range of Y11 students is greater

(Total for Question 12 is 2 marks)

13　In a restaurant there are 7 starters, 9 main courses and 6 desserts on the menu.
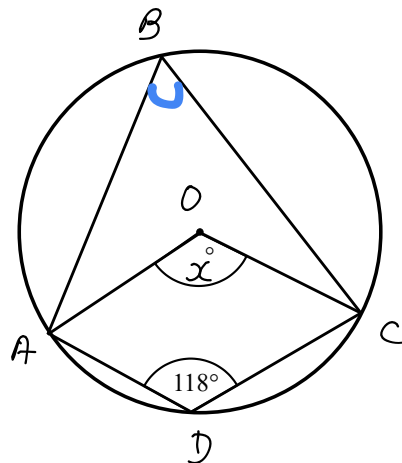
Work out the total number of ways of choosing a starter, a main course and a dessert.

$7 \times 9 \times 6$

$= 378$

378

(Total for Question 13 is 2 marks)

14

A, B, C and D are points on the circumference of a circle, centre O.

Angle $ADC = 118°$
Angle $AOC = x°$

Work out the value of x
You must show all your working.

$180° - 118° = 62°$ (opposite angles in cyclic quad. add to $180°$)
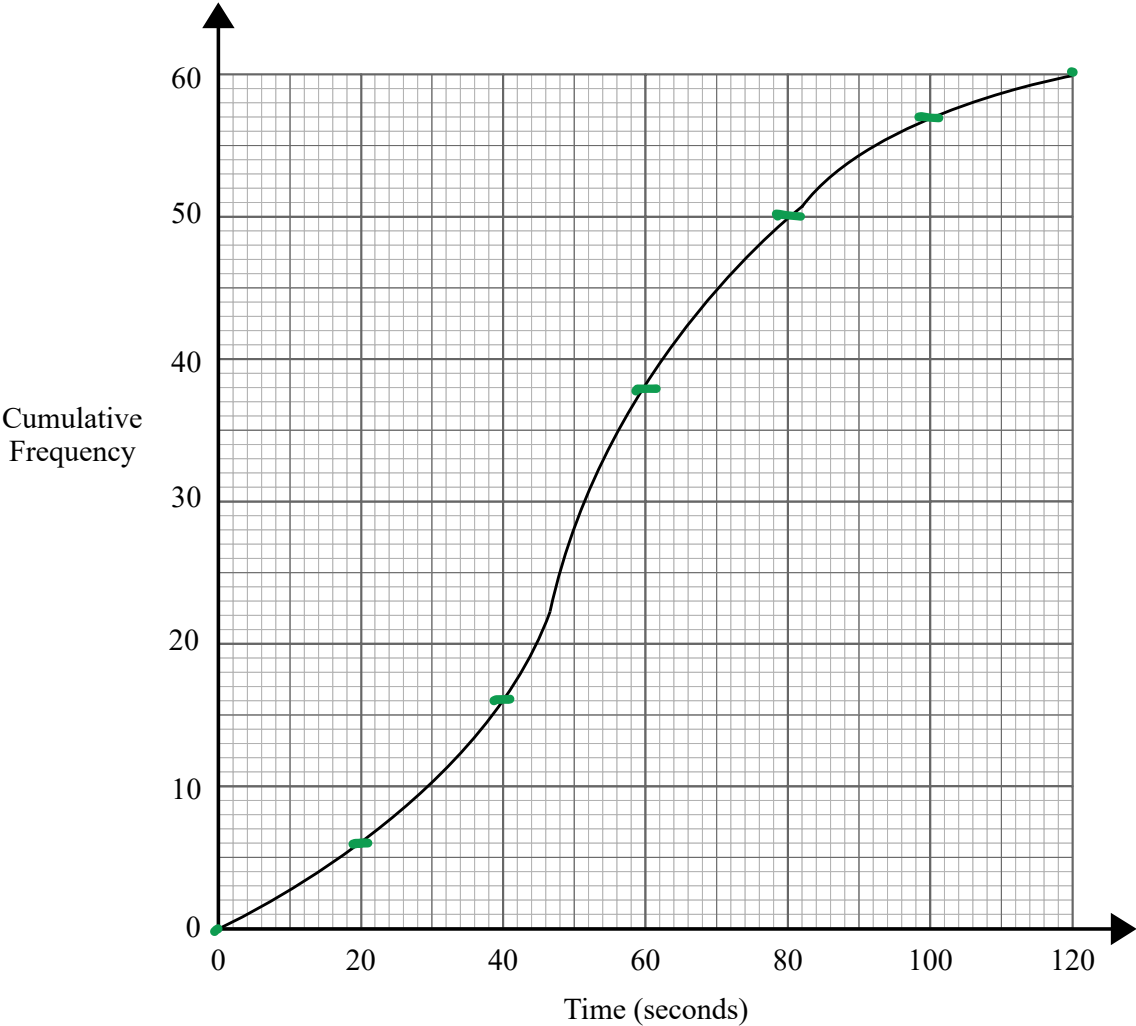
$x = 62 \times 2 = 124°$

(Angle at center is twice the angle at circumference)

124°

(Total for Question 14 is 3 marks)

15 The cumulative frequency graph gives information about the time, in seconds, each of 60 people took to complete a puzzle.

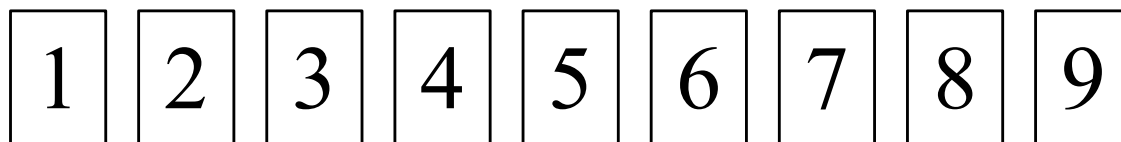Cumulative Frequency

Time (seconds)

Use the graph to complete the frequency table to give information about the time, seconds, each of the 60 people took to complete the puzzle.

Time taken	Frequency
$0 < t \le 20$	6
$20 < t \le 40$	10
$40 < t \le 60$	22
$60 < t \le 80$	12
$80 < t \le 100$	7
$100 < t \le 120$	3

Subtract

6 − 0
16 − 6
38 − 16
50 − 38
57 − 50
60 − 57

(Total for Question 15 is 2 marks)

16 Here are 9 cards.
Each card has a number on it.

$$\boxed{1}\ \boxed{2}\ \boxed{3}\ \boxed{4}\ \boxed{5}\ \boxed{6}\ \boxed{7}\ \boxed{8}\ \boxed{9}$$

Emma takes two cards at random.
Work out the probability that the sum of the two cards is an odd number.
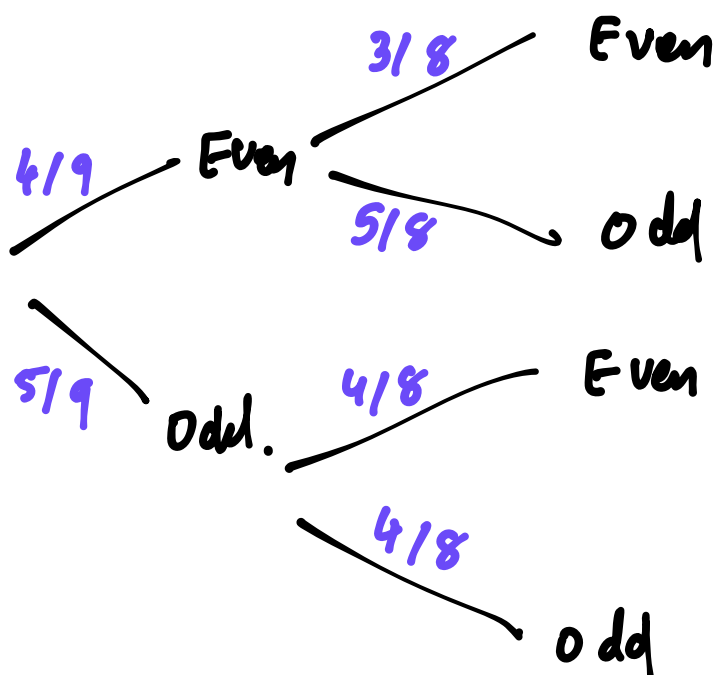
$$P(EO) + P(OE)$$

$$= \left(\frac{4}{9} \times \frac{5}{8} \right) + \left(\frac{5}{9} \times \frac{4}{8} \right)$$

$$= \frac{20}{72} + \frac{20}{72} = \frac{40}{72}$$

$$\frac{5}{9}$$

(Total for Question 16 is 3 marks)

17 (a) Using $x_{n+1} = \sqrt{6x_n - 1}$

with $x_0 = 5$

(a) Find the values of x_1, x_2 and x_3.

$$x_1 = \sqrt{6(5) - 1} = \sqrt{29} = 5.3851648\ldots$$

$$x_2 = \sqrt{6x_1 - 1}$$

$$x_3 = \sqrt{6(Ans) - 1}$$

$x_1 =$ 5.385164807

$x_2 =$ 5.595622293

$x_3 =$ 5.707340 34

(3)

(b) Explain the relationship between the values of x_1, x_2 and x_3 and the equation $x^2 - 6x + 1 = 0$
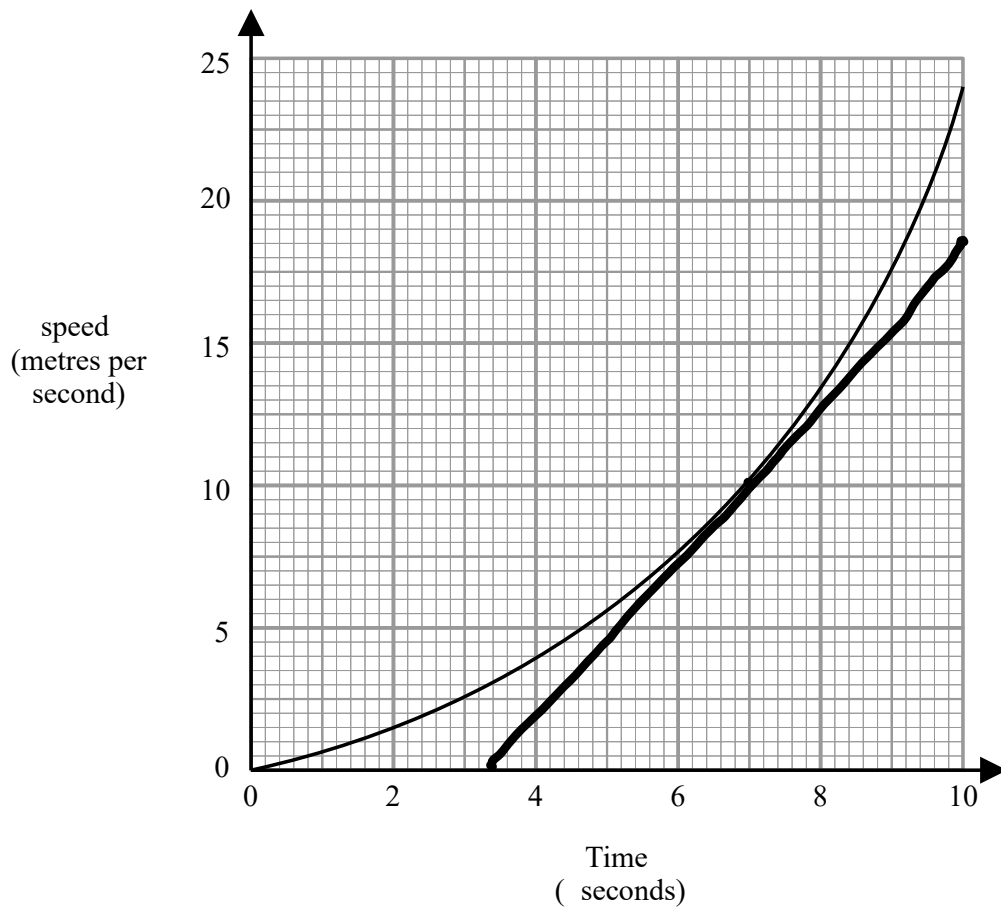
$$x^2 = 6x - 1$$

$$x = \sqrt{6x - 1}$$

They are estimates on the Solutions to the equation.

(2)

(Total for Question 17 is 5 marks)

18 The graph below shows the speed of a car, in metres per second, t seconds after it starts moving.

(a) Calculate an estimate for the gradient of the graph when $t = 7$
You must show how you get your answer.

$(3.4, 0) \qquad (7, 10)$

$$\frac{dy}{dx} = \frac{10 - 0}{7 - 3.4} = \frac{10}{3.6} = 2.\dot{7}$$

_____ $2.\dot{7}$

(3)

(b) Describe what the gradient in part (a) represents.

The acceleration

(1)

(Total for Question 18 is 4 marks)

19 Show that $\dfrac{2x}{x-3} - \dfrac{3x-1}{x+3} + 1$ can be written in the form $\dfrac{ax+b}{x^2-9}$

where a and b are integers.

$$\frac{2x(x+3)}{(x-3)(x+3)} - \frac{(3x-1)(x-3)}{(x+3)(x-3)} + \frac{(x+3)(x-3)}{(x+3)(x-3)}$$
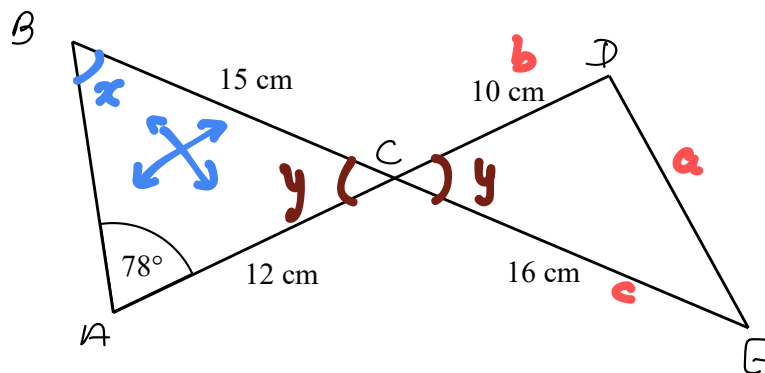
$$= \frac{2x^2+6}{x^2-9} - \frac{(3x^2-10x+3)}{x^2-9} + \frac{x^2-9}{x^2-9}$$

$$= \frac{2x^2+6-3x^2+10x-3-x^2+9}{x^2-9}$$

$$= \frac{16x-12}{x^2-9}$$

20 Here is a shape formed from two triangles ABC and CDE.
ACD and BCE are straight lines.

AC = 12 cm BC = 15 cm CE = 16 cm CD = 10 cm
Angle BAC = 78°

Work out the length of DE.
Give your answer correct to 3 significant figures.

$$\frac{\sin x}{12} = \frac{\sin 78}{15}$$

$$\sin x = \frac{\sin 78}{15} \times 12$$

$$= 0.7825\ldots$$

$$x = \sin^{-1}(0.7825\ldots)$$

$$x = 51.4917\ldots$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$= 10^2 + 16^2 - 2(10)(16) \cos(50.508\ldots)$$

$$= 152.49$$

$$a = 12.3487 \text{ cm}$$

$$y = 180 - (78 + 51.4917\ldots)$$

$$= 50.50828\ldots$$

12.3 _____ cm

(Total for Question 20 is 5 marks)

21 Solve algebraically the simultaneous equations

$$x^2 + 2y^2 = 10 \quad \text{———(1)}$$
$$3x - 2y = 8 \quad \text{———(2)}$$

$3x = 2y + 8$

$x = \dfrac{2y + 8}{3} \quad \text{—(3)}$

$\left(\dfrac{2y + 8}{3} \right)^2 + 2y^2 = 10$

$\dfrac{4y^2 + 32y + 64}{9} + 2y^2 = 10$

$4y^2 + 32y + 64 + 18y^2 = 90$

$22y^2 + 32y - 26 = 0$

$11y^2 + 16y - 13$

$a = 11 \qquad b = 16 \qquad c = -13$

$y = \dfrac{-16 \pm \sqrt{16^2 - 4(11)(-13)}}{2(11)}$

$y = 0.581$

$y = -2.035$

Sub y in [3]

$x = 3.05 \quad \text{or}$

$x = 1.31$

$(3.05, 0.581), (1.31, -2.035)$

(Total for Question 21 is 5 marks)

22 A solid cube has a length of 4.8 cm, correct to 1 decimal place.
The cube has a mass of 220 grams, correct to 2 significant figures.

Work out the upper bound for the density of the cube.
Give your answer in g/cm³ correct to 2 decimal places.

$$D = \frac{M}{V}$$

$$\text{upper density} = \frac{\text{upper mass}}{\text{lower volume}}$$

$$\text{lower volume} = (4.75)^3$$
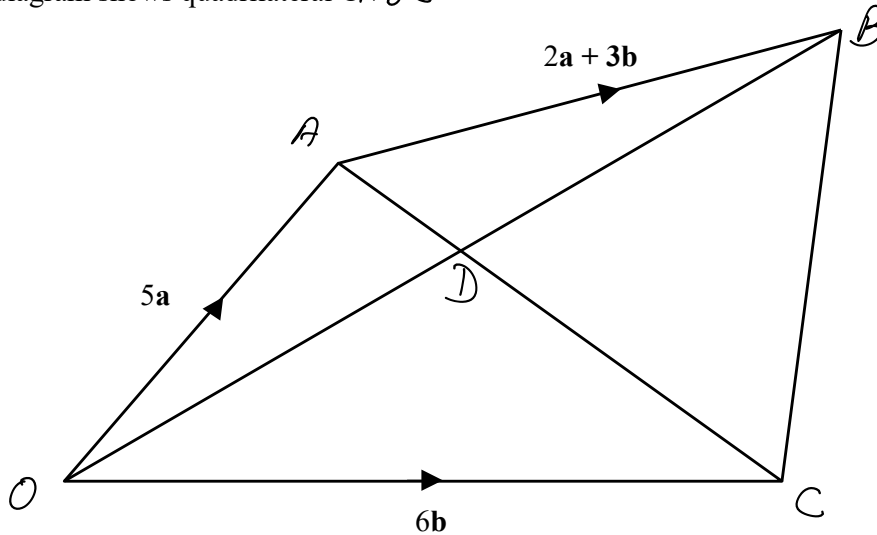$$= 107.171875 \ cm^3$$

$$\text{upper mass} = 225 \ g$$

$$D = \frac{225}{107.1718\ldots}$$

$$= 2.10 \ g/cm^3$$

2.10 _____ g/cm³

(Total for Question 22 is 4 marks)

23   The diagram shows quadrilateral $OABC$

ADB and ODC are straight lines.

$\vec{OA} = 5a$ $\vec{OB} = 6b$ $\vec{AC} = 2a + 3b$

Using a vector method, find the ratio $AD : DB$

$\vec{AB} = -5a + 6b$

$\vec{AD} = x(-5a + 6b)$

$\vec{OC} = 5a + 2a + 3b = 7a + 3b$

$\vec{AD} = \vec{AO} + \vec{OD} = \vec{AO} + K(\vec{OC})$

$= -5a + K(7a + 3b)$

$= -5a + 7Ka + 3Kb$

compare a

$-5x = -5 + 7K$

$-5x = -5 + 7(2x)$

$-5x = -5 + 14x$

$5 = 19x$

$x = \dfrac{5}{19}$

compare b

$6x = 3K$

$K = 2x$

$\dfrac{5}{19} : \dfrac{14}{19} = 5 : 14$

$\underline{\underline{5 : 14}}$

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS