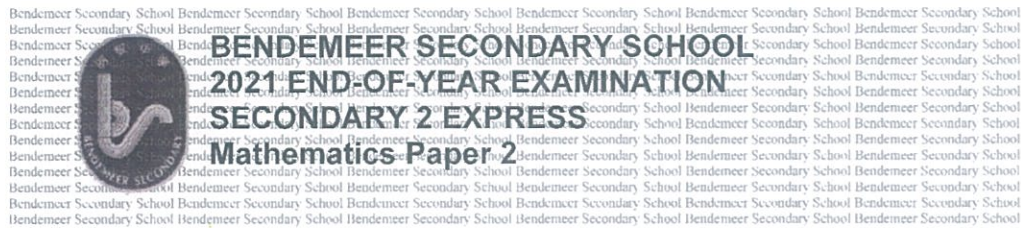


Register No.	Class

Name : _____



DATE : 11 Oct 2021
 DURATION : 1 hour 15 minutes
 TOTAL : 50 marks

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
 Write in dark blue or black pen on both sides of the paper.
 You may use a 2B pencil for any diagrams or graphs.
 Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Answer **all** questions.
 Write your answers in the spaces provided on the question paper.
 All the diagrams in this paper are **not** drawn to scale.
 If working is needed for any question, it must be shown with the answer.
 Omission of essential working will result in loss of marks.
 The use of an approved scientific calculator is expected, where appropriate.
 If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
 For π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

The number of marks is given in brackets [] at the end of each question or part question.

FOR EXAMINER'S USE
50

This document consists of 11 printed pages including this cover page.

[Turn over

MATHEMATICAL FORMULAE

Compound Interest

$$\text{Total amount} = P \left(1 + \frac{r}{100} \right)^n$$

Mensuration

$$\text{Curved surface area of cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4 \pi r^2$$

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

$$\text{Volume of sphere} = \frac{4}{3} \pi r^3$$

$$\text{Area of triangle ABC} = \frac{1}{2} ab \sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2} r^2 \theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

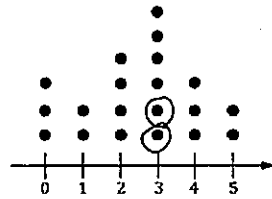
$$\text{Standard Deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

Answer all the questions.

- 1 (a) The number of goals scored in 20 football matches was recorded. The results are shown in the dot diagram.

Find the

- (i) mode,
(ii) median,
(iii) mean.



(ii) Middle position

$$= \frac{20+1}{2}$$

$$= 10.5$$

$$\frac{3+3}{2} = 3$$

(iii) $\frac{2(1) + 4(2) + 6(3) + 3(4) + 2(5)}{20}$

$$= \frac{50}{20}$$

$$= 2.5$$

Answer (a)(i) 3 goals [1]

(a)(ii) 3 goals [1]

(a)(iii) 2.5 goals [2]

- (b) The monthly salaries, correct to nearest hundred dollars, of 27 employees, are represented in the following stem-and-leaf diagram.

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

Key: 1|0 means \$1000

- (i) Find the median monthly salary.

$$\frac{27+1}{2} = 14$$

Answer (b)(i) \$ 2400 [1]

- (ii) Which average (mean or median) would be an appropriate measure of central tendency for this set of data? Give a reason to explain your answer.

Answer (b)(ii) Median, as there is an outlier which will affect the mean. [2]

- 2 Given that p is inversely proportional to the square of q and $p = 1$ when $q = 2$, find the value of p when $q = 8$.

$$p = \frac{k}{q^2}$$

when $q = 2, p = 1$

$$1 = \frac{k}{2^2}$$

$$k = 4$$

$$p = \frac{4}{q^2}$$

when $q = 8,$

$$p = \frac{4}{8^2}$$

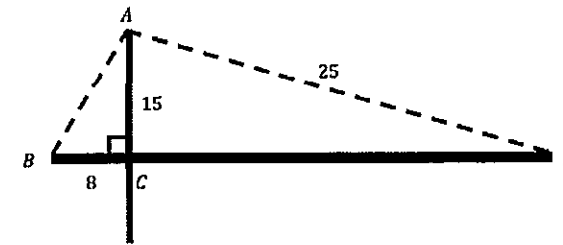
$$= \frac{1}{16}$$

Answer

$$\frac{1}{16}$$

[3]

- 3 The diagram below shows the top part of a construction crane with $BC = 8$ m, $AC = 15$ m and $AD = 25$ m. A steel cable BD is pulled taut through the ends B, A and D .



By showing your workings clearly, determine if $\angle BAD$ is 90° .

Answer

Using Pythagoras Theorem,

$$AB = \sqrt{15^2 + 8^2}$$

$$= 17$$

$$CD = \sqrt{25^2 - 15^2}$$

$$= 20$$

$$AB^2 + AD^2 = 17^2 + 25^2 = 914$$

$$BD^2 = 28^2 = 784$$

[5]

Since $BD^2 \neq AB^2 + AD^2, \therefore \angle BAD \neq 90^\circ$

- 4 Mrs Tan bought 50 litres of apple juice and poured the apple juice equally into x bottles.
 (a) Write down an expression, in terms of x , for the volume, in litres, of apple juice in each bottle.

Answer (a) $\frac{50}{x}$ litres [1]

- (b) Mrs Tan bought the same amount of guava juice and poured the guava juice into $(x - 5)$ bottles.
 Write down an expression, in terms of x , for the volume, in litres, of guava juice in each bottle.

Answer (b) $\frac{50}{x-5}$ litres [1]

- (c) It is given that the volume of guava juice in each bottle is 0.5 litres more than the volume of apple juice in each bottle.
 Write down an equation in x and show that it reduces to $x^2 - 5x - 500 = 0$.

$$\frac{50}{x-5} - \frac{50}{x} = \frac{1}{2}$$

$$\frac{50x}{x(x-5)} - \frac{50(x-5)}{x(x-5)} = \frac{1}{2}$$

$$\frac{50x - 50(x-5)}{x(x-5)} = \frac{1}{2}$$

$$\frac{250}{x^2 - 5x} = \frac{1}{2}$$

$$500 = x^2 - 5x$$

$$x^2 - 5x - 500 = 0$$

(shown)

Answer (c) Shown above [3]

- (d) Solve the equation $x^2 - 5x - 500 = 0$.

$$(x + 20)(x - 25) = 0$$

$$x + 20 = 0 \quad \text{or} \quad x - 25 = 0$$

$$x = -20 \quad \quad \quad x = 25$$

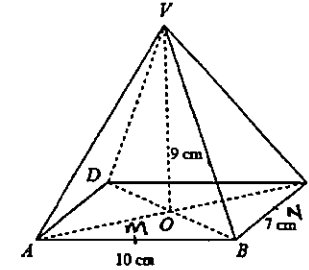
Answer (d) $x = 25$ or $x = -20$ [3]

- (e) Hence, find the volume, in litres, of apple juice in one bottle.

$$\frac{50}{25} = 2$$

Answer (e) 2 litres [1]

- 5 A souvenir was designed in the shape of a solid rectangular pyramid as shown below. $AB = 10$ cm, $BC = 7$ cm and $VO = 9$ cm.



- (a) Find the volume of the souvenir.

$$\frac{1}{3} \times 10 \times 7 \times 9 = 210$$

Answer (a) 210 cm³ [2]

- (b) Find the total surface area of the souvenir.

Let M and N be the midpoints of AB and BC respectively.

Using Pythagoras' Theorem,

$$VM^2 = 3.5^2 + 9^2$$

$$= 93.25$$

$$VM = \sqrt{93.25}$$

$$VN^2 = 9^2 + 5^2$$

$$= 106$$

$$VN = \sqrt{106}$$

Total surface area

$$= 2\left(\frac{1}{2}\right)(10)(\sqrt{93.25}) + 2\left(\frac{1}{2}\right)(7)(\sqrt{106}) + 10 \times 7$$

$$= 238.635$$

$$= 239 \text{ cm}^2 \text{ (3 s.f.)}$$

Answer (b) 239 cm² [4]

- 6 The length of times, t minutes, taken by a class of 40 students to complete a test is given by the following frequency table.

Time (t min)	$20 < t \leq 25$	$25 < t \leq 30$	$30 < t \leq 35$	$35 < t \leq 40$
Frequency	6	x	14	8

- (a) Find the value of x .

$$x = 40 - 6 - 14 - 8$$

$$= 12$$

Answer (a) $x = 12$ [1]

- (b) Find the mean time the students took to complete the test.

$$\text{MEAN} = \frac{6(22.5) + 12(27.5) + 14(32.5) + 8(37.5)}{40}$$

$$= \frac{1220}{40}$$

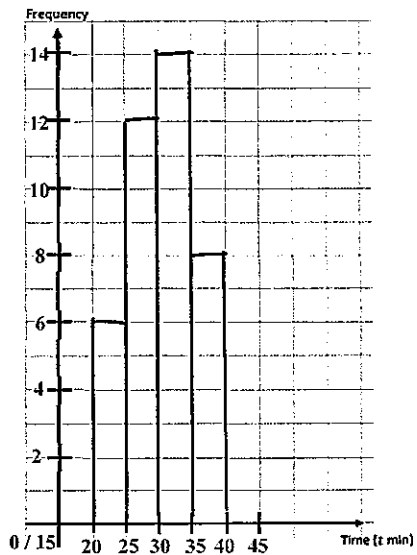
$$= 30.5 \text{ min}$$

Answer (b) 30.5 min [2]

- (c) In the answer space below, draw a histogram that will accurately represent the same information given in the above frequency table. Include appropriate labelling where necessary.

Answer

[2]



- 7 A ball is thrown upwards from a rooftop of a building. The height, h metres, of the ball above ground at time t sec, can be modelled by the equation $h = -6t^2 + 14t + 80$.

- (a) State the height of the building.

Answer (a) 80 metres [1]

- (b) The table shows some values of h and t .

t sec	0	1	2	3	4	5
h metres	80	88	p	68	40	q

Find the values of p and q .

Answer (b) $p = 84$

$q = 0$ [2]

- (c) Using a scale of 2 cm to 1 sec on the horizontal axis and 2 cm to 10 metres on the vertical axis, draw the graph of $h = -6t^2 + 14t + 80$ on the grid on page 9. [3]

- (d) Use your graph to estimate

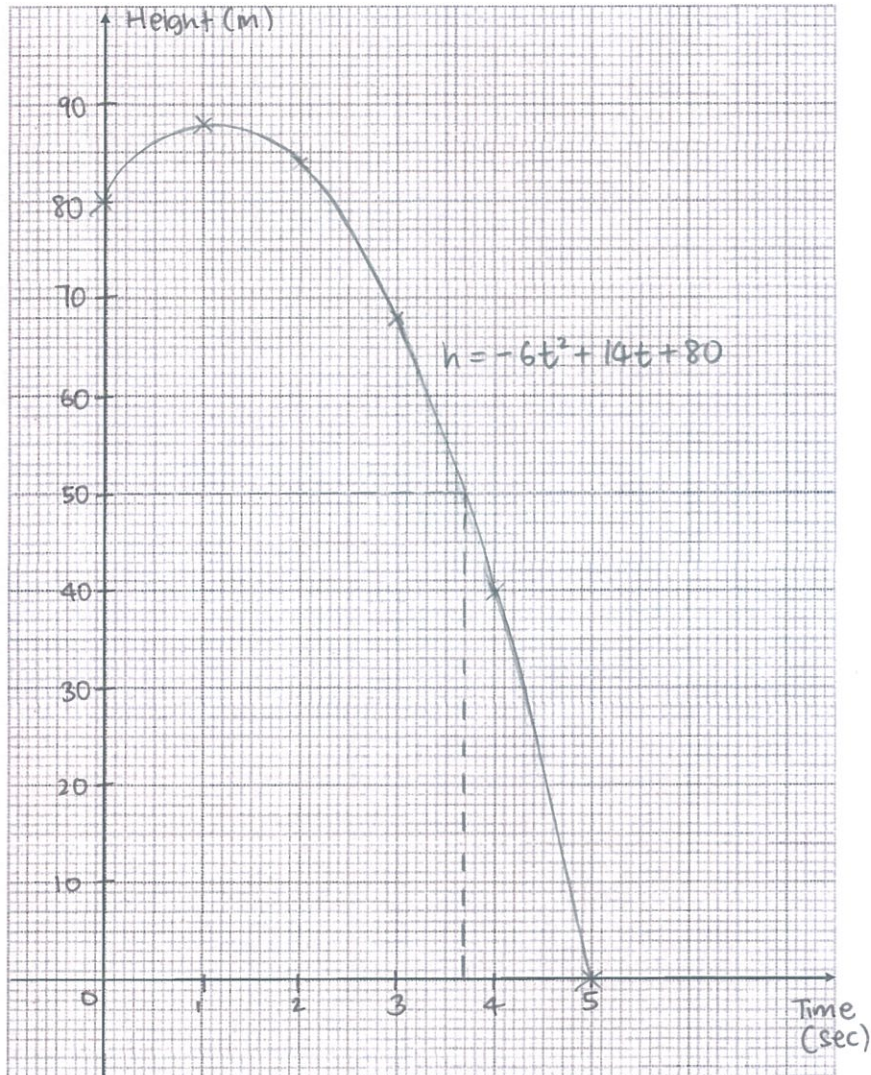
- (i) the maximum height of the ball above the ground,

(d)(i) 88 metres [1]

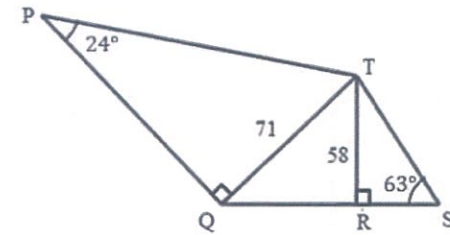
- (ii) the time when the ball is 50 metres above the ground,

(d)(ii) 3.7 secs [1]

Answer for part (c)



8 The diagram shows a field $PQRST$. $TQ = 71$ m, $TR = 58$ m, $\angle TPQ = 24^\circ$ and $\angle TSQ = 63^\circ$.



(a) Calculate the perimeter of the field $PQRST$.

$$\tan 24^\circ = \frac{71}{PQ}$$

$$PQ = \frac{71}{\tan 24^\circ} = 159.46 \text{ m}$$

$$QR = \sqrt{71^2 - 58^2} = \sqrt{1677} = 40.9511 \text{ m}$$

$$\tan 63^\circ = \frac{58}{RS} \\ RS = \frac{58}{\tan 63^\circ} = 29.5524 \text{ m}$$

$$\sin 63^\circ = \frac{58}{TS} \\ TS = \frac{58}{\sin 63^\circ} = 65.0949 \text{ m}$$


$$\sin 24^\circ = \frac{71}{PT}$$

$$PT = \frac{71}{\sin 24^\circ} = 174.5601 \text{ m}$$


$$\begin{aligned} \text{perimeter} &= 159.46 + 40.9511 + 29.5524 \\ &\quad + 65.0949 + 174.5601 \\ &= 469.61 \\ &= 470 \text{ m} \end{aligned}$$

Answer (a) 470 m [5]

- (b) The town council would like to fix a wire fence around the entire field. The best deal sought by the management is shown below :



Outdoor Garden Iron Wire Green Safety Fence Roll

NO RATINGS 

Brand: OEM | More Lawn & Garden from OEM Free Shipping

\$14.23 / Roll
\$25.61 -44%

Features :
Garden Fence : This fence screen are made of iron wire with PE plated, more durable and not easy to break.
Mesh Structure : Uniform mesh, smooth mesh surface, concise structure, beautiful and practical, strong stability.
Wide Use : Perfect climbing plant support no matter short or tall plant, also can be used as fences, dividers.
Plant frame : Adjustable frame to wrap the led string light to décor your festival party wall or fence, or hanging other small things, creating atmosphere.
Garden Decoration : Tidy up the yard, beautiful and orderly, make the plants convenient to take care of and clean.

Specification :
Material : Iron Wire + PE Plated
Color : Green
Size : 0.5 m x 3 m (width x length)

How much will the town council have to pay for the fence? Show your working clearly.

$$\begin{aligned} \text{No. of rolls} &= \frac{469.61}{3} \\ &= 156.5 \\ &\approx 157 \end{aligned}$$

$$\begin{aligned} \text{Total amt} &= 157 \times \$14.23 \\ &= \$2234.11 \end{aligned}$$

Answer (b) \$ 2234.11 [2]

~ End of Paper ~