Class	Index Number

Name : Mark Scheme

METHODIST GIRLS' SCHOOL

Founded in 1887

PRELIMINARY EXAMINATION 2025
Secondary 4

Wednesday
20 August 2025

MATHEMATICS
Paper 1

4052/01
2 h 15 min

Candidates answer on the Question Paper.

INSTRUCTIONS TO CANDIDATES

Write your name, class and index number in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** the questions.
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.
The total of the marks for this paper is 90.

90

Mathematical Formulae

Compound Interest

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

Mensuration

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

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

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

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

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

Arc length = $r\theta$, where θ is in radians

Sector area = $\frac{1}{2}r^2\theta$, where θ 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

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

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

1 Simplify $\dfrac{4a^{-2}}{3r} \div \dfrac{\left(27a^{6}\right)^{\frac{1}{3}}}{r^{3}}$, giving your answer in positive index.

$$\frac{4a^{-2}}{3r} \div \frac{\left(27a^{6}\right)^{\frac{1}{3}}}{r^{3}} = \frac{4a^{-2}}{3r} \div \frac{3a^{2}}{r^{3}} \quad \boxed{\text{M1 for } 3a^{2}}$$

$$= \frac{4a^{-2}}{3r} x \frac{r^{3}}{3a^{2}}$$

$$= \frac{4r^{2}}{9a^{4}} \quad \boxed{\text{A1}}$$

Answer.................................... [2]

---

2 $4^{m-3} \times 8^{3m-1} = 4$

Use the laws of indices to find the value of m. Show your working.

$$4^{m-3} \times 8^{3m-1} = 4$$

$$2^{2(m-3)} \times 2^{3(3m-1)} = 2^{2} \quad \boxed{\text{M1 for expressing terms in base 2}}$$

$$2^{2m-6+9m-3} = 2^{2}$$

$$2^{11m-9} = 2^{2}$$

$$11m - 9 = 2$$

$$11m = 11$$

$$m = 1 \quad \boxed{\text{A1}}$$

Answer $m =$ .... [2]

3 Two identical containers are filled with a mixture of rose syrup and evaporated milk in the ratio of 5 : 3 and 4 : 7.
The contents of the containers are poured into a big bowl and mixed thoroughly.
Find the ratio of the rose syrup to the evaporated milk in the big bowl.

1st Container	2nd Container	
5 : 3	4 : 7	M1 for both ratios
55 : 33	32 : 56	

Rose Syrup : Evaporated milk = 87 : 89 $\boxed{\text{A1}}$

Answer .... : .... [2]

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4 Simplify $\dfrac{(3m-1)(2m+3)}{3}+\dfrac{5m-2}{6}$.

$$\frac{(3m-1)(2m+3)}{3}+\frac{5m-2}{6}=\frac{2\left(6m^2+9m-2m-3\right)+5m-2}{6}$$

M1 for expansion of (3m-1)(2m+3)

$$=\frac{12m^2+14m-6+5m-2}{6}$$

$$=\frac{12m^2+19m-8}{6} \quad \boxed{\text{A1}}$$

Answer.................................... [2]

5 A map is drawn to a scale of 1 : 400 000.

(a) Find the actual distance, in km, represented by 10.5 cm on the map

1 cm : 4 km
10.5 cm : 42 km $\boxed{\text{A1}}$

Answer................................ km [1]

(b) A forest covers an area of 64 km^2.
Find, in cm^2, the area representing the forest on the map.

1 cm : 4 km
1 cm^2 : 16 km^2
4 cm^2 : 64 km^2 $\boxed{\text{A1}}$

Answer................................ cm^2 [1]

6 **(a)** Written as a product of its prime factors, $240 = 2^4 \times 3 \times 5$ and $2750 = 2 \times 5^3 \times 11$.

(i) Find the smallest positive integer n for which $\sqrt{2750n}$ is a whole number.

$$2750n = 2^2 \times 5^4 \times 11^2$$

M1 for perfect square

$$2 \times 5^3 \times 11n = 2^2 \times 5^4 \times 11^2$$

$$n = \frac{2^2 \times 5^4 \times 11^2}{2 \times 5^3 \times 11}$$

$$= 2 \times 5 \times 11$$

$$= 110$$

A1

Answer.................................... [2]

(ii) Find the smallest positive integer k for which $240k$ is a multiple of 2750.

LCM of 240 and 2750 $= 2^4 \times 3 \times 5^3 \times 11$

$240k = 2^4 \times 3 \times 5^3 \times 11$

$k = \dfrac{2^4 \times 3 \times 5^3 \times 11}{2^4 \times 3 \times 5} = 5^2 \times 11 = 275$ A1

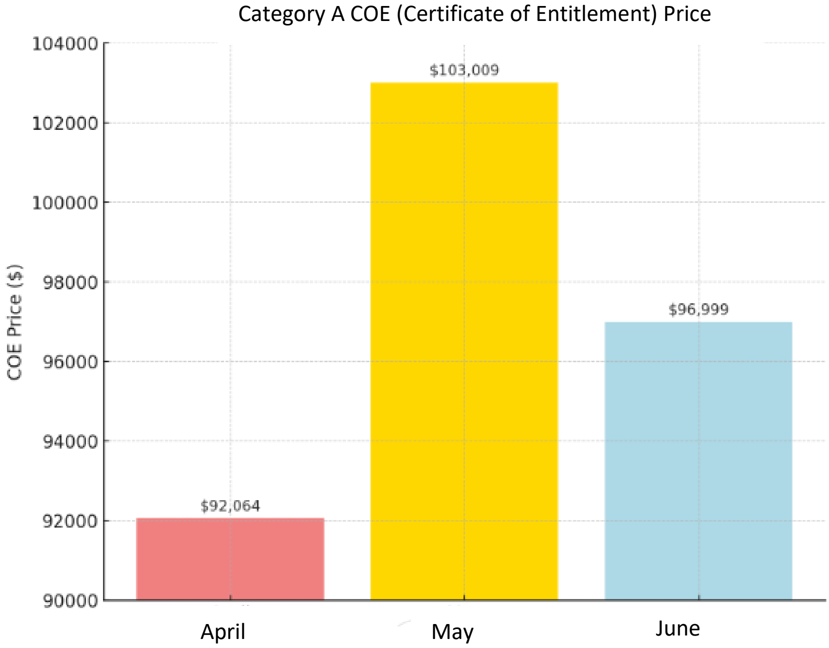
Answer.................................... [1]

(b) $Y = a^{18} \times b^{12} \times c^{36}$ where a, b and c are prime numbers.
Explain why Y is a perfect cube.

Answer

The indices of the prime factors a, b and c are multiples of 3. [1]

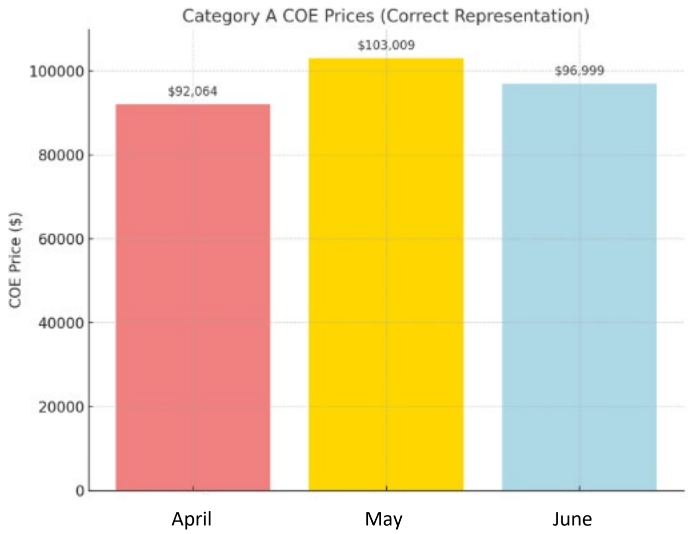
7 The graph shows the Category A Certificate of Entitlement (COE) price for cars up to 1600cc for the months of April, May and June in 2025.



State one aspect of the graph that maybe misleading and explain how this may lead to a misinterpretation of the graph.

Answer

By starting the vertical axis at $90000 and not at zero, it **exaggerates small differences** in COE prices, making the COE price of May look dramatically more expensive than April or June, even though the actual difference is relatively small. [2]



8 The interior angles of a hexagon are in the ratio 3 : 5 : 6 : 7 : 7 : 8.
Find the smallest exterior angle of the hexagon.

size of largest interior angle $= 180°(6-2) \times \dfrac{8}{36}$ M1

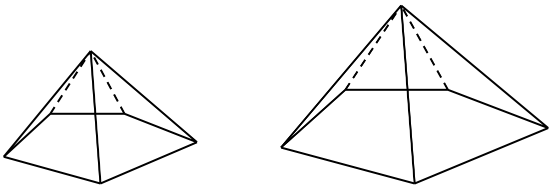
$= 160°$

smallest exterior angle $= 180° - 160°$

$= 20°$ A1

Answer.................................. ° [2]

9 P and Q are similar pentagonal pyramids.
The ratio of surface areas of the two pyramids, P and Q, is 81 : 121.



(a) Find the ratio of the height of pyramid P to that of pyramid Q.

$\text{Height}_P : \text{Height}_Q = \sqrt{81} : \sqrt{121} = 9:11$ $\boxed{\text{A1}}$

Answer……………… : ……………. [1]

(b) Both pyramids are completely filled with sand. Find the mass of the sand, in kg, in pyramid Q if the mass of sand in the pyramid P is 192 g.

$\frac{0.192}{\text{M}_Q} = \frac{9^3}{11^3}$ $\boxed{\text{M1}}$

$\text{M}_Q = \frac{11^3 \times 0.192}{9^3}$

$= 0.35055$

$= 0.351 \text{ kg } (3\text{sf})$ $\boxed{\text{A1}}$

Answer………………………….. kg [2]

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10 Factorise completely.

(a)

$5 - 5x^2 = 5(1 - x^2)$ $\boxed{\text{M1}}$

$= 5(1-x)(1+x)$ $\boxed{\text{A1}}$

Answer……………………………… [2]

(b)

$2xq - 2yq - yp + xp$

$= 2q(x-y) + p(x-y)$ $\boxed{\text{M1}}$

$= (2q+p)(x-y)$ $\boxed{\text{A1}}$

Answer……………………………… [2]

11 Simplify $\dfrac{3}{x+1}-\dfrac{x+4}{x^2+3x+2}$.

$$\frac{3}{x+1}-\frac{x+4}{x^2+3x+2}=\frac{3}{x+1}-\frac{x+4}{(x+1)(x+2)}$$

M1 for factorisation of x^2+3x+2

$$=\frac{3(x+2)-(x+4)}{(x+1)(x+2)}$$

$$=\frac{3x+6-x-4}{(x+1)(x+2)}$$

M1 for making single fraction

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

M1 for simplifying numerator

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

$$=\frac{2}{(x+2)}$$

A1

Answer…………………………………. [4]

12 **(a)** Express x^2-6x+8 in the form of $a(x+b)^2+c$.

$$x^2-6x+8 = x^2-6x+(-3)^2+8-(-3)^2 \quad \boxed{\text{M1}}$$
$$=(x-3)^2+8-9$$
$$=(x-3)^2-1 \quad \boxed{\text{A1}}$$

Answer .... [2]

(b) The curve $y=x^2-6x+8$ is drawn.
Using your answer in **(a)**, write down

(i) the coordinates of the turning point,

(3, −1) $\boxed{\text{A1}}$

Answer (.............. , ...). [1]

(ii) the equation of the line of symmetry of the curve.

$x=3$ $\boxed{\text{A1}}$

Answer .... [1]

---

13 **(a)** Derek invested a sum of money in an account paying compound interest at 3.4% per annum. After six years, he earned a total interest of $2665.76.
Calculate the sum of money Derek invested in the account to the nearest dollar.

$$P+2665.76 = P\left(1+\frac{3.4}{100}\right)^6 \quad \boxed{\text{M1}}$$
$$P\left(1+\frac{3.4}{100}\right)^6 - P = 2665.76$$
$$P=\frac{2665.76}{\left(1+\frac{3.4}{100}\right)^6-1}$$
$$=12000.014$$
$$=12000 \text{ (nearest dollar)} \quad \boxed{\text{A1}}$$

Answer $................................. [2]

13 **(b)** Cathy is going on a holiday to Australia. She changes 3500 Singapore dollars (SGD) into 4172 Australian dollars (AUD) at a bank.

(i) Calculate the exchange rate between SGD and AUD to the nearest cents.

$$3500 \text{ SGD} = 4172 \text{ AUD}$$

$$1 \text{ SGD} = \frac{4172}{3500} \text{AUD}$$

$$= 1.192 \text{ AUD}$$

$$= 1.19 \text{ AUD (nearest cents)} \quad \boxed{\text{A1}}$$

Answer 1 SGD = ……………………AUD [1]

(ii) At the end of Cathy's holiday in Australia, she has some AUD left. If she converts this amount back to SGD at a money changer.
The exchange rate between AUD and SGD is 1 AUD = 0.91 SGD.

Determine, when changing AUD back to SGD, if the exchange rate offered by the money changer is of better value for Cathy than the bank's exchange rate found in **(b)(i)**.

Answer
From **a(i)**, 1.192 AUD =1SGD

$$1 \text{ AUD} = \frac{1}{1.192} \text{ SGD}$$

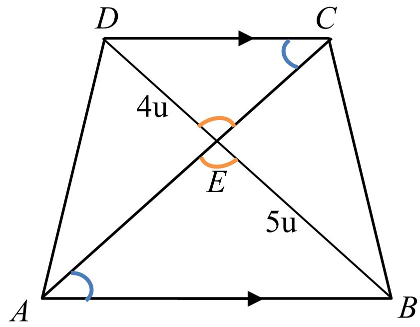
$$= 0.83892 \text{ SGD} \quad \boxed{\text{M1}}$$

$$= 0.84 \text{ SGD (nearest cents)}$$

<u>Cathy will receive 0.07 SGD more for every 1 AUD at the exchange rate of 1 AUD = 0.91 SGD, hence it is a better value than the bank's exchange rate found in (a)(i).</u> $\boxed{\text{A1}}$

[2]

14 The diagram shows a trapezium $ABCD$ such that AB is parallel to DC.
AC and BD are diagonals of the trapezium $ABCD$.
E is a point on BD such that $5DE = 4EB$.



(a) Show that triangle ABE and triangle CDE are similar.

Answer

In ΔABE and ΔCDE,

$\angle EAB = \angle ECD$ (alt. $\angle$s)

$\angle AEB = \angle CED$ (vert. opp. $\angle$s)

$\therefore \Delta ABE$ is similar to ΔCDE. (AA similarity test)

[2]

(b) Calculate the value of

(i) $\dfrac{\text{area of } \Delta ABE}{\text{area of } \Delta CDE}$,

$$\frac{\text{area of } \Delta ABE}{\text{area of } \Delta CDE} = \left(\frac{5}{4}\right)^2 = \frac{25}{16} \quad \boxed{\text{A1}}$$

Answer.................................... [1]

(ii) $\dfrac{\text{area of } \Delta ABE}{\text{area of } \Delta ABC}$.

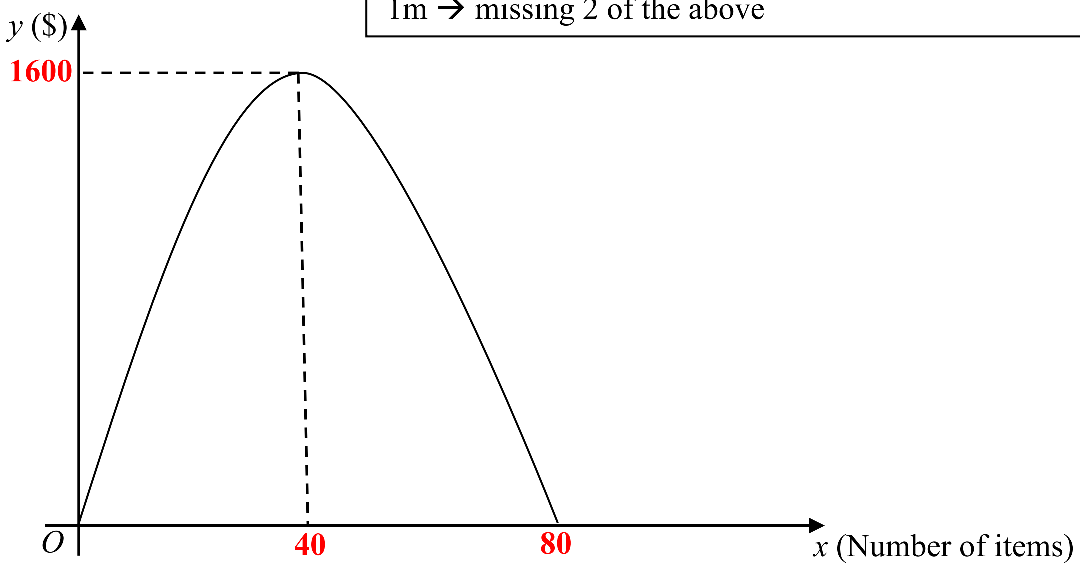
$$\frac{\text{area of } \Delta ABE}{\text{area of } \Delta ABC} = \frac{5}{9} \quad \boxed{\text{A1}}$$

Answer.................................... [1]

15 The revenue y (in dollars) for selling x items is given by $y = 80x - x^2$ for $0 \le x \le 80$.

(a) Sketch the graph of $y = 80x - x^2$ for $0 \le x \le 80$, showing its turning point, x and y-intercepts.

3m→ correct shape and **all** 2 intercepts & turning point
2m → missing 1 of the above
1m → missing 2 of the above



[2]

(b) "Peter claims that it is possible for him to make a revenue of $2000."
Using your answer in **(a)**, determine if Peter's statement is correct.

Answer

Incorrect
From the graph, Peter can only make a **maximum revenue of $1600**. A1

[1]

16 The pressure, P N/m^2 of a gas contained in an enclosed container, held at a constant temperature is inversely proportional to the volume of the gas, V m^3.

The pressure of a certain mass of gas is 500 N/m^2 when the volume at a constant temperature is 2 m^3.

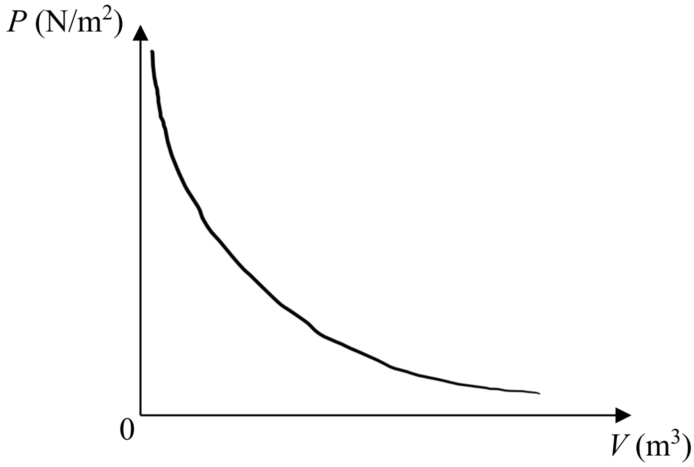
(a) Find an equation connecting P and V.

$$P = \frac{k}{V}$$
$$k = 500 \times 2$$
$$= 1000 \quad \boxed{\text{M1}}$$
$$\therefore P = \frac{1000}{V} \quad \boxed{\text{A1}}$$

Answer……………………………… [2]

(b) Sketch the graph of P against V.

Answer



[1]

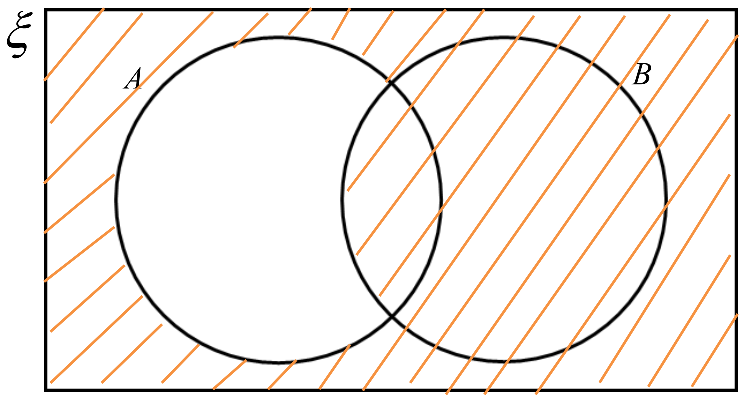
(c) The volume of the gas in the container is increased by 400%.
Calculate the percentage change in the pressure of the gas.

$$P_{new} = \frac{1000}{5V} \quad \boxed{\text{M1}}$$
$$= \frac{1}{5}\left(\frac{1000}{V}\right)$$
$$= \frac{1}{5}P$$

$$\text{Percentage change} = \frac{1-5}{5} \times 100\%$$
$$= -80\% \quad \boxed{\text{A1}}$$

Answer…………………………% [2]

17 On the Venn diagram, shade the region which represents $A' \cup B$.



[1]

(b)

$\varepsilon = \{\text{integers } x : 1 \le x < 10\}$
$P = \{\text{multiples of } 3\}$
$Q = \{\text{perfect squares}\}$

(i) List the elements in $P' \cap Q'$.

$\varepsilon = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$
$P = \{3,6,9\},\ P' = \{1, 2, 4, 5, 7, 8\}$
$Q = \{1,4,9\},\ Q' = \{2, 3, 5, 6, 7, 8\}$
$P' \cap Q' = \{2, 5, 7, 8\}$ $\boxed{\text{A1}}$

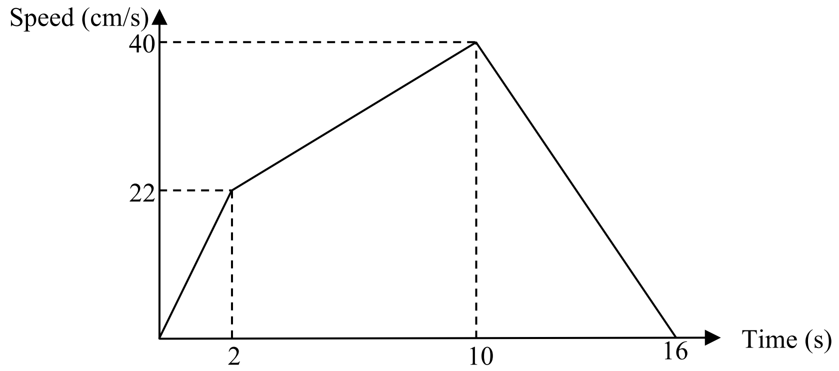
Answer.. [1]

(ii) A number, y is chosen at random from the set $P \cup Q$.
Find the probability that $y \notin P$.

$\frac{2}{5}$ $\boxed{\text{A1}}$

Answer.................................... [1]

18 The diagram shows the speed-time graph of a particle during a period of 16 seconds.



(a) Calculate the speed of the car after 6 seconds.

$$\frac{v-22}{4}=\frac{40-22}{8}$$ $\boxed{\text{M1}}$

$$v-22=\frac{9}{4}(4)$$

$$v=9+22$$

$$=31$$ $\boxed{\text{A1}}$

OR

$$\frac{40-v}{10-6}=\frac{40-22}{10-2}$$

$$40-v=9$$

$$v=40-9$$

$$=31$$

Answer..............................cm/s[2]

(b) Calculate the average speed of the particle during the 16 seconds.

$$\text{Total distance}=\frac{1}{2}(2)(22)+\frac{1}{2}(22+40)(8)+\frac{1}{2}(40)(6)$$

$$=22+248+120$$

$$=390\text{ cm}$$ $\boxed{\text{M1 for total distance}}$

$$\text{Average speed}=\frac{390}{16}$$

$$=24.375\text{ cm/s}$$ $\boxed{\text{A1}}$

Answer..............................cm/s [2]

19 There are 85 cookies and 25 packets of Ribena in a snack box. After x cookies have been consumed, the probability that a packet of Ribena is picked to be consumed is $\frac{5}{18}$. Calculate the number of cookies, x, that have been consumed.

$$\text{P(packet of drink is consumed)} = \frac{5}{18}$$

$$\frac{25}{85+25-x} = \frac{5}{18} \quad \boxed{\text{M1}}$$

$$5(110) - 5x = 25(18)$$

$$5x = 550 - 450$$

$$x = \frac{100}{5}$$

$$x = 20 \quad \boxed{\text{A1}}$$

Answer.................................... [2]

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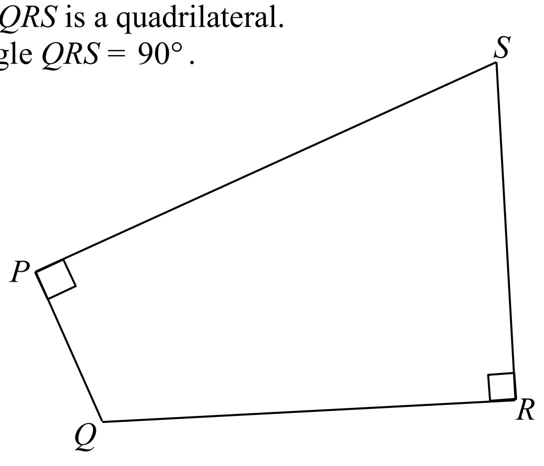
20 In the diagram, $PQRS$ is a quadrilateral.
Angle SPQ = Angle QRS = $90°$.



Show that $\sin \angle RSP = \sin \angle PQR$.

Answer

sum of angles of a quadrilateral =360° $\boxed{\text{M1 for sum of angles of quadrilateral}}$

$$\angle RSP + \angle PQR = 360° - 90° - 90°$$

$$= 180° \quad \boxed{\text{M1 for supplementary angles}}$$

$\therefore \angle RSP$ and $\angle PQR$ are supplementary angles.

$$\angle PQR = 180° - \angle RSP$$

$$\sin \angle RSP = \sin(180° - \angle RSP) \quad \boxed{\text{M1}}$$

$$\sin \angle PQR = \sin \angle RSP \text{ (shown)}$$

[3]

21 In a fuel economy test conducted for 100 cars, the average distance travelled per litre of fuel (km/l) were recorded and given in the table below.

Distance travelled per litre (d km/l)	Frequency
$10 < d \le 11$	14
$11 < d \le 12$	20
$12 < d \le 13$	38
$13 < d \le 14$	16
$14 < d \le 15$	12

(a) Calculate an estimate for the mean distance travelled per litre of fuel.

12.42 km/l $\boxed{\text{A1}}$

Answer.................................... [1]

(b) Explain why the value of the mean in part **(a)** is an estimate of the mean distance travelled per litre of fuel.

Answer

The mean of a set of grouped data is an estimate because **grouped data does not give the exact individual values.** Since individual data points are not available, we cannot compute the actual mean, only an estimated mean using **the class midpoints**.

[1]

(c) Find the standard deviation.

1.18050 = 1.18 km/l (3sf) $\boxed{\text{A1}}$

Answer.................................... [1]

22 S is the point $(1, -3)$ and T is the point $(5, w)$.

$\overrightarrow{PQ} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$ and $\overrightarrow{QR} = \begin{pmatrix} 8 \\ 6 \end{pmatrix}$.

(a) Find $\left|\overrightarrow{QR}\right|$.

$$\left|\overrightarrow{QR}\right| = \sqrt{8^2 + 6^2}$$
$$= \sqrt{100}$$
$$= 10 \text{ units} \quad \boxed{\text{A1}}$$

Answer.................................... [1]

(b) Express $\overrightarrow{ST}$ as a column vector, in terms of w.

$$\overrightarrow{ST} = \overrightarrow{SO} + \overrightarrow{OT}$$
$$= \begin{pmatrix} -1 \\ 3 \end{pmatrix} + \begin{pmatrix} 5 \\ w \end{pmatrix}$$
$$= \begin{pmatrix} 4 \\ 3 + w \end{pmatrix} \quad \boxed{\text{A1}}$$

Answer.................................... [1]

(c) Find the value of w given that $\overrightarrow{ST}$ is parallel to $\overrightarrow{PQ}$.

$$\begin{pmatrix} 4 \\ 3 + w \end{pmatrix} = k\begin{pmatrix} 1 \\ 4 \end{pmatrix}$$
$$= \begin{pmatrix} k \\ 4k \end{pmatrix} \quad \boxed{\text{M1}}$$
$$k = 4$$
$$3 + w = 4(4)$$
$$w = 16 - 3$$
$$= 13 \quad \boxed{\text{A1}}$$

Answer w = ... [2]

23 The first four terms in a sequence of numbers are given below.

$T_1 = 1\times3$	$= 3\times1$	$= 3\times1$	$= 3$
$T_2 = 1\times3+3\times3$	$= 3\times(1+3)$	$= 3\times4$	$= 12$
$T_3 = 1\times3+3\times3+5\times3$	$= 3\times(1+3+5)$	$= 3\times9$	$= 27$
$T_4 = 1\times3+3\times3+5\times3+7\times3$	$= 3\times(1+3+5+7)$	$= 3\times16$	$= 48$

(a) Find an expression, in terms of n, for T_n.

$T_n = 3n^2$ $\boxed{\text{A1}}$

Answer $T_n =$ .... [1]

(b) T_p and T_{p+1} are consecutive terms in the sequence.
Find and simplify an expression, in terms, of p, for $T_{p+1} - T_p$.

$$\begin{aligned} T_{p+1} - T_p &= 3(p+1)^2 - 3p^2 \\ &= 3(p^2+2p+1) - 3p^2 \\ &= 3(2p+1) \\ &= 6p+3 \quad \boxed{\text{A1}} \end{aligned}$$

Answer.................................... [1]

(c) Explain why two consecutive terms of the sequence cannot have a difference of 4.

Answer

When $6p+3=4$

$p = \dfrac{1}{6}$ [1]

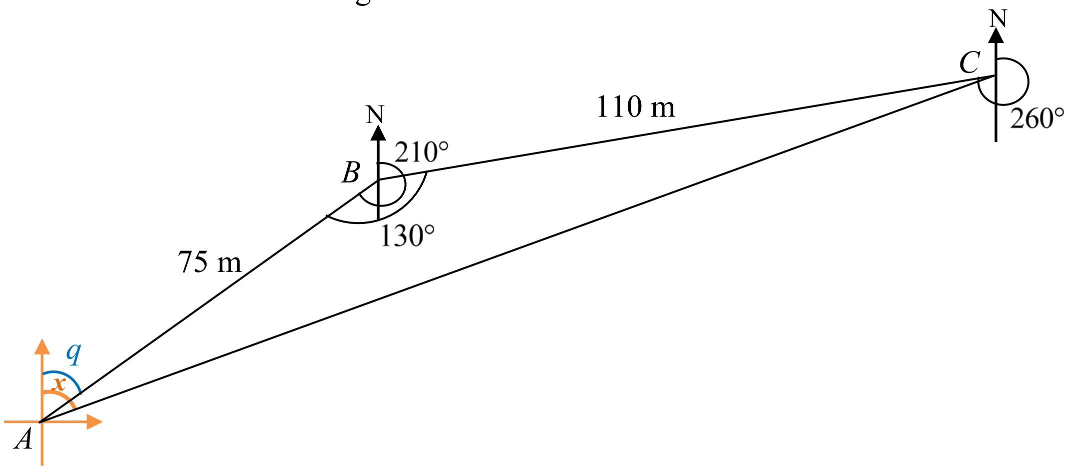
p is not an integer $\boxed{\text{A1}}$

(d) The first three terms of a second sequence are 12, 27 and 48.
By using **(a)** or otherwise, write down an expression, in terms of n, for the n^{th} term, S_n of this second sequence.

$3(n+1)^2$ $\boxed{\text{A1}}$

Answer.................................... [1]

24 A, B and C are three points on a level ground.
Angle $ABC = 130°$.
A is 75 m from B on a bearing of $210°$.
B is 110 m from C on a bearing of $260°$.



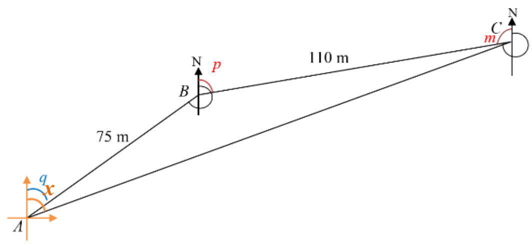
(a) Calculate the distance, AC,

$$AC = \sqrt{75^2 + 110^2 - 2(75)(110)\cos 130°}, AC > 0 \quad \boxed{\text{M1}}$$
$$= 168.3181$$
$$= 168 \text{ m (3sf)} \quad \boxed{\text{A1}}$$

Answer.................................... [2]

(b) Calculate the bearing of C from A..

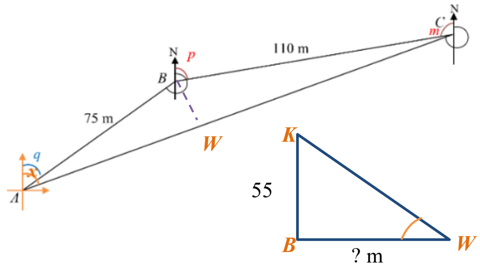
$$\frac{\sin \angle BAC}{110} = \frac{\sin 130°}{168.3181} \quad \boxed{\text{M1}}$$
$$\sin \angle BAC = \frac{110 \sin 130°}{168.3181}$$
$$\angle BAC = \sin^{-1}\left(\frac{110 \sin 130°}{168.3181}\right)$$
$$= 30.0416°$$
$$q = 180 - (360 - 210) \quad \boxed{\text{M1}}$$
$$= 30$$
$$x = 30 + 30.0416$$
$$= 60.0416$$



Bearing of C from A=060.0° (1dp) $\boxed{\text{A1}}$

Answer.................................... [3]

(c) A kite was seen flying 55 m vertically above point B.
Find the greatest angle of elevation of the kite observed by a person walking in a straight path from A to C.



$$\sin 30.0416° = \frac{BW}{75}$$ $\boxed{\text{M1 for } BW}$

$$BW = 75\sin 30.0416°$$

OR

$$\frac{1}{2}(75)(110)\sin 130° = \frac{1}{2}(168.3181)BW$$

$$BW = \frac{\frac{1}{2}(75)(110)\sin 130° \times 2}{168.3181}$$

$$BW = 37.5471 \text{ m}$$

$\boxed{\text{M1 for } BW = 37.5471\text{m}}$

$$\tan \angle KWB = \frac{55}{37.5471}$$ $\boxed{\text{M1}}$

$$\angle KWB = \tan^{-1}\left(\frac{55}{37.5471}\right)$$

$$= 55.6796°$$

$$= 55.7° \text{ (1dp)}$$ $\boxed{\text{A1}}$

greatest angle of elevation of the kite =55.7°

Answer.................................... [4]

25 An enrichment centre offers Basic and Advanced programming lessons on weekdays and weekends.
Each student attends 4 weekly lessons per month.
The table shows the number of students who attend weekly Basic and Advanced programming lessons in a particular month

.

	Basic	**Advanced**
Weekday	18	9
Weekend	15	13

This information can be represented by the matrix ***T***.

$$T = \begin{pmatrix} 18 & 9 \\ 15 & 13 \end{pmatrix}$$

(a) Evaluate the matrix $\boldsymbol{W} = 4\boldsymbol{T}$.

$W = \begin{pmatrix} 72 & 36 \\ 60 & 52 \end{pmatrix}$

Answer $W =$ .... [1]

(b) The enrichment centre charges \$60 per lesson for Basic Programming and \$110 per lesson for Advanced Programming.
The lesson charges can be represented by a 2×1 matrix ***N*** where $N = \begin{pmatrix} 60 \\ 110 \end{pmatrix}$.

(i) Find ***WN***.

WN

$= \begin{pmatrix} 72 & 36 \\ 60 & 52 \end{pmatrix}\begin{pmatrix} 60 \\ 110 \end{pmatrix}$

$= \begin{pmatrix} 8280 \\ 9320 \end{pmatrix}$

Answer $WN =$ .... [1]

(ii) Explain what the elements in ***WN*** represent.

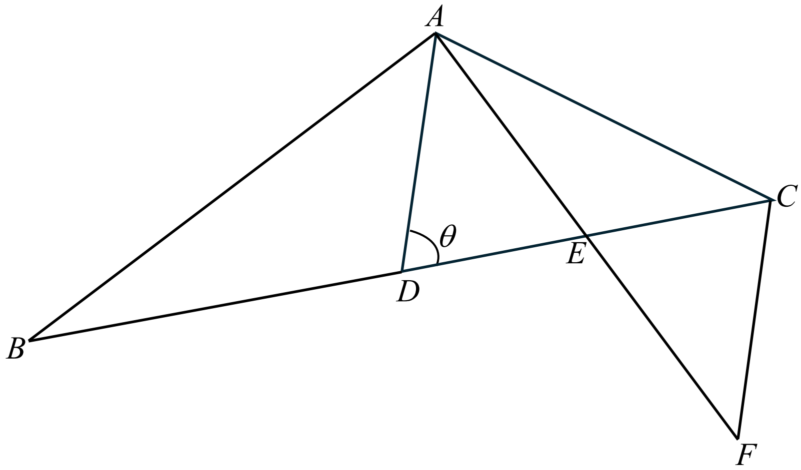
Answer
The elements represent the **total amount of money** the enrichment centre collects **monthly** for lessons on **weekdays and weekends** respectively. [1]

(c) The charges for both Basic Programming and Advanced Programming lessons are increased by 7%, and the attendance remains the same.
Calculate the total amount of money collected monthly after the increase in charges.

$$\text{total amount collected} = \frac{107}{100}\times(8280+9320) \quad \boxed{\text{M1}}$$
$$= \frac{107}{100}\times 17600$$
$$= \$18832 \quad \boxed{\text{A1}}$$

Answer.................................... [2]

26 In the diagram, D and E are points on BC such that $BD = DC = AC$.
Triangle ADE is congruent to triangle FCE and angle $ADE = \theta$.



Show that triangle ABD is congruent to triangle FAC.
Give a reason for each statement you make.

Answer

$BD = AC$ (Given)

Since $\Delta ADE \equiv \Delta FCE$, $AD = FC$ and $\angle ADE = \angle FCE = \theta°$

M1 for $AD = FC$

Since $DC = AC$, ΔADC is an isosceles triangle.

$\angle CAD = \theta°$ (base $\angle$s of isos.Δ)

M1 for angle CAD

Since $\angle ADE = \angle FCE = \theta°$, $AD // CF$.

$\angle ACF = (180 - \theta)°$ $(\text{int.}\angle)$

$\angle BDA = (180 - \theta)°$ $(\text{supp. }\angle)$

$\angle ACF = \angle BDA$

$\therefore \Delta ABD \equiv \Delta FAC$ (SAS)

For finding angle ACF on the condition that AD//CF is stated.

M1 for finding angle BDA

[3]

END OF PAPER