CANBERRA SECONDARY SCHOOL

2023 End-of-Year Examination

Secondary Two Normal Academic

2NA

MATHEMATICS
Paper 1

9 Oct 2023
1 hour 15 minutes
1020h – 1135h

Name: _____ ( ) **Class:** _____

READ THESE INSTRUCTIONS FIRST

Write your full name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, 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 number of marks for this paper is 50.

FOR MARKER'S USE		
	Marks Awarded	Max Marks
Total		50

1 Simplify $\frac{3x}{4}+\frac{5x+2}{2}$

Answer ..... [2]

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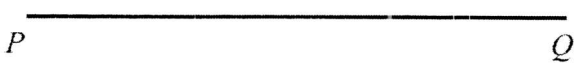
2 **(a)** Construct triangle PQR such that $QR = 5$ cm and $PR = 6$ cm.
Line PQ has been provided for you.
Answer



[1]

(b) Measure and write down the size of $\angle QRP$.

Answer $\angle QRP =$ ..... [1]

3 y is inversely proportional to x^3.

It is given that $y = 16$ when $x = 2$.

(a) Form an equation connecting x and y.

Answer ..... [2]

(b) Find the value of y when $x = 4$.

Answer ..... [1]

---

4 Simplify the following.

(a) $\dfrac{5x^4y}{25xy^5}$

Answer ..... [1]

(b) $\dfrac{5x^3}{x} \times \dfrac{1}{10x}$

Answer ..... [2]

5 4 workers take 12 days to build a tentage.

(a) How many workers are needed if the tentage is to be built in 8 days?

Answer ..... workers [2]

(b) State one assumption made.

.....

..... [1]

---

6 Find x and y in the given simultaneous equations below.

$3x - y = 6$

$x + y = 1$

Answer $x =$ ..... [2]

$y =$ ..... [1]

7 A bag contains 20 balls which are numbered 1 to 20.
Find the probability of drawing at random, a ball that is

(a) an even number,

Answer ..... [1]

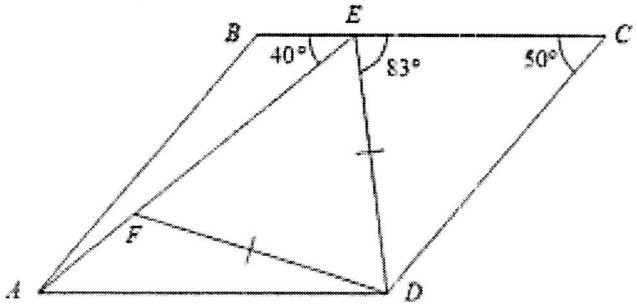
(b) greater than 6 but smaller than 12,

Answer ..... [1]

(c) a prime number.

Answer ..... [1]

8 In the diagram below, *ABCD is a parallelogram.*
$DE = DF$, $\angle BEA = 40°$, $\angle CED = 83°$ and $\angle ECD = 50°$.



Find

(a) $\angle CDE$,

Answer ..... [1]

(b) $\angle EDF$,

Answer ..... [1]

(c) $\angle ADF$.

Answer ..... [2]

---

9 Expand and simplify the following.

(a) $(a+3)(4+2a)$

Answer ..... [2]

(b) $3(3n-4)^2$

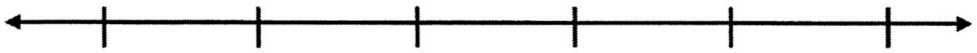
Answer ..... [2]

10 **(a)** Solve the inequality $-3x+1 \leq -8$.

Answer ..... [2]

(b) Illustrate the solution on the number line given below.

Answer (b)



[1]

(c) Hence, write down the smallest odd number that satisfies $-3x+1 \leq -8$.

Answer ..... [1]

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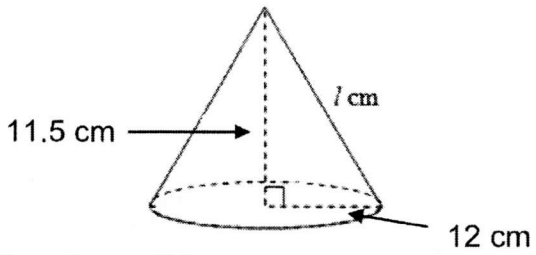
11 The diagram below shows a cone of base radius 12 cm, height 11.5 cm and slant height l cm



(a) Calculate the volume of the cone.

Answer ..... cm^3 [2]

(b) Find the value of l.

Answer ..... cm [2]

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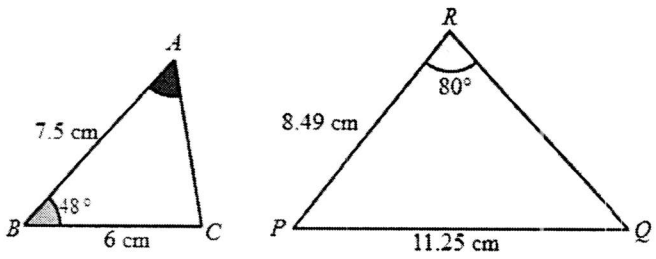
12 In the figures below, ΔABC is similar to ΔPQR.



Calculate

(a) length of CA,

Answer ..... cm [2]

(b) $\angle BAC$.

Answer ..... [2]

---

13 Solve the following equations.

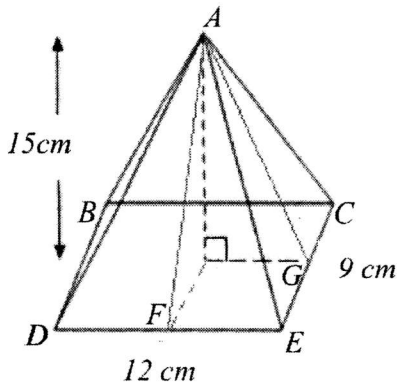
(a) $\frac{1}{2}(y+1)-6=0$

Answer $y =$ ..... [2]

(b) $\frac{x+1}{2}=\frac{5x-2}{4}$

Answer $x =$ ..... [2]

14 A rectangular pyramid has a base of 9 cm by 12 cm and a height of 15 cm.



(a) Find the volume of the pyramid,

Answer ..... cm^3 [2]

(b) Find the slant height AG,

Answer ..... cm [2]

(c) Given AF= 17cm, calculate the total surface area of the pyramid.

Answer ..... cm^2 [3]

End of Paper

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MATHEMATICS
Paper 2

10 Oct 2023
1 hour 15 minutes
0800h – 0915h

Name: _____ ( ) **Class:** _____

READ THESE INSTRUCTIONS FIRST

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FOR MARKER'S USE		
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Total		50

1 It is given that T is directly proportional to Q.

When $Q = 5$, $T = 20$.

(a) Find an equation connecting T and Q.

Answer ..... [2]

(b) Find the value of T when $Q = 8$.

Answer ..... [1]

(c) Find the percentage increase in T, when Q increases by 200%.

Answer ..... [1]

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2 400 ml of paint is needed to paint 2 m^2 of a wall.
Find the amount of paint needed to paint 3.5 m^2 of a wall.

Answer ..... *ml* [2]

3 **(a)** Factorise each of the following expressions.

(i) $4ab + 8b$

Answer ..... [1]

(ii) $2x^2 + 7x + 6$

Answer ..... [1]

(b) **(i)** Factorise $p^2 - q^2$.

Answer ..... [1]

(ii) Hence, evaluate $105^2 - 5^2$ without the use of a calculator.

Answer ..... [2]

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4 Jacinda's monthly salary is \$3500.
If she decides to spend 40% of her salary and saves the rest, find the

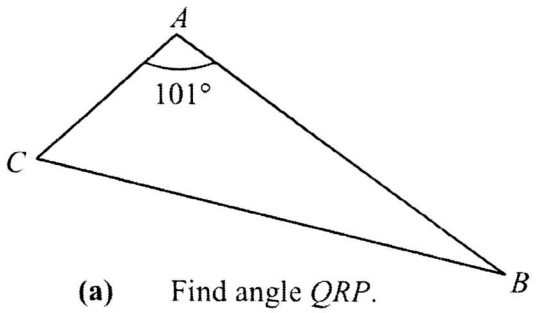
(a) amount she spends in a month,

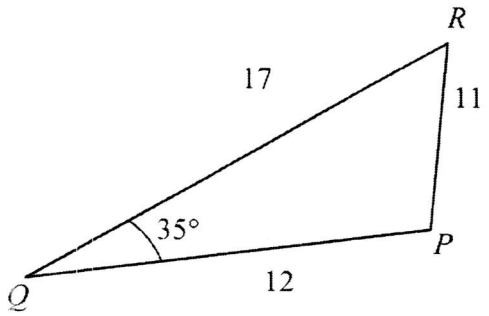
Answer \$ ..... [1]

(b) amount she saves in a year.

Answer \$ ..... [2]

5 Triangle ABC is congruent to triangle PQR.
All the lengths are in centimetres.





(a) Find angle QRP.

Answer ..... [2]

(b) Find BC.

Answer ..... cm [1]

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6 The scale of a map is 4 cm : 1 km.

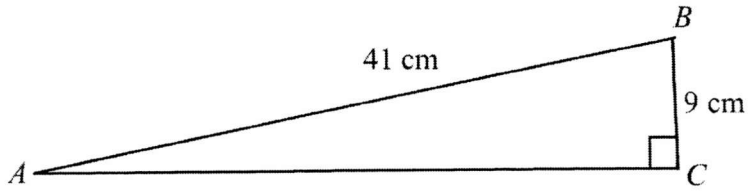
(a) Write down this scale in the form 1 : n.

Answer ..... [1]

(b) Universal Studios Singapore is represented by an area of 32 cm^2 on the map.
Calculate the actual area of Universal Studio Singapore in square kilometres.

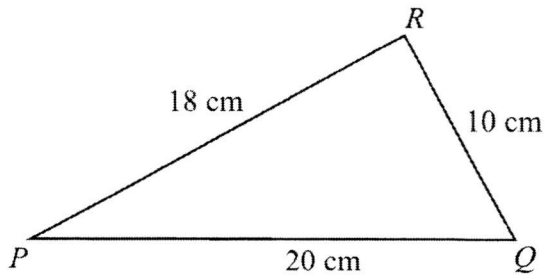
Answer ..... km^2 [2]

7 **(a)** ABC is a right-angled triangle.
Find the length of AC.



Answer ..... cm [2]

(b) Another triangle PQR has the dimensions shown below.
$PQ = 20$ cm, $QR = 10$ cm, $PR = 18$ cm.



Stating your reasons clearly, determine whether triangle PQR is a right-angled triangle.

Answer .....

.....[2]

8 The stem-and-leaf diagram shows the daily number of visitors to the Night Safari for a particular month.

Stem	Leaf									
24	1	3	4	8						
25	0	0	3	4	6	6				
26	3	3	3	3	4	6	6	7	8	9
27	0	1	1	2	4	5	6			
28	0	0	3							

Key:
24 | 1 represents 241 visitors.

(a) Find the highest number of visitors.

Answer ..... [1]

(b) Find the lowest number of visitors.

Answer ..... [1]

(c) Find the modal number of visitors.

Answer ..... [1]

(d) Find the median number of visitors.

Answer ..... [1]

(e) John says that this data is for the month of October which has 31 days.
Explain why he is wrong.

Answer ..... [1]

(f) Find the percentage number of days with more than 272 visitors.

Answer ..... [1]

9 Diagram I shows a chocolate.
It is spherical in shape and has a radius of 1.5 cm.

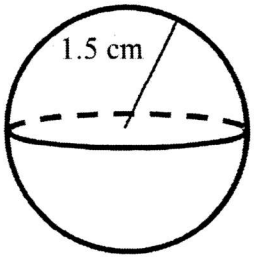


Diagram I

(a) Show that the volume of the chocolate, correct to one decimal place is 14.1 cm^3.

Answer

[2]

(b) The chocolate is now cut into half in the form of a hemisphere and wrapped in gold foil as shown in Diagram II.
Calculate the total area of gold foil needed for one hemisphere, assuming there is no overlap.

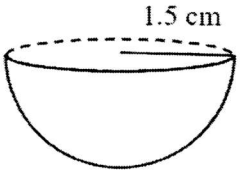


Diagram II

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

(c) Given that the cost of chocolate is \$0.10 per cm^3 and the cost of gold foil is \$0.20 per cm^2, determine the selling price of one **hemispherical** chocolate so that a profit can be made.

.....

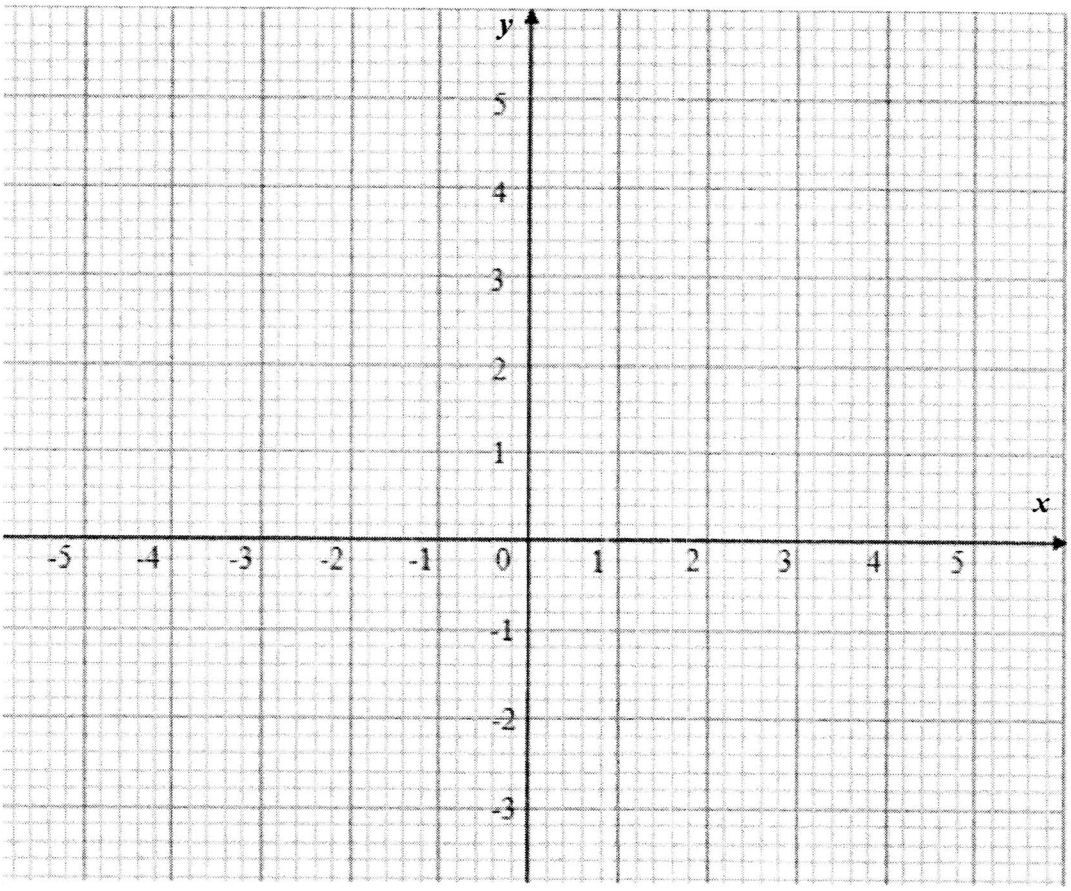
..... [3]

10 **(a)** Complete this table of values for $y = \frac{1}{2}x + 1$.

x	-4	0	2
y		1	

[2]

(b) On the axes given below, draw the line $y = \frac{1}{2}x + 1$.



[2]

(c) From your graph, find the value of y when $x = -2$.

Answer ..... [1]

(d) State the gradient of the line $y = \frac{1}{2}x + 1$.

Answer ..... [1]

11 At a concert, a child ticket costs $\$x$ each and an adult ticket costs $\$y$ each.

(a) Arjun bought 1 child ticket and 1 adult ticket and paid \$65.
Write down an equation connecting x and y.

Answer ..... [1]

(b) Siti bought 3 child tickets and 2 adult tickets and paid \$150.
Write down an equation connecting x and y.

Answer ..... [1]

(c) Hence, solve these two equations simultaneously.

Answer $x =$ ..... , $y =$ ..... [3]

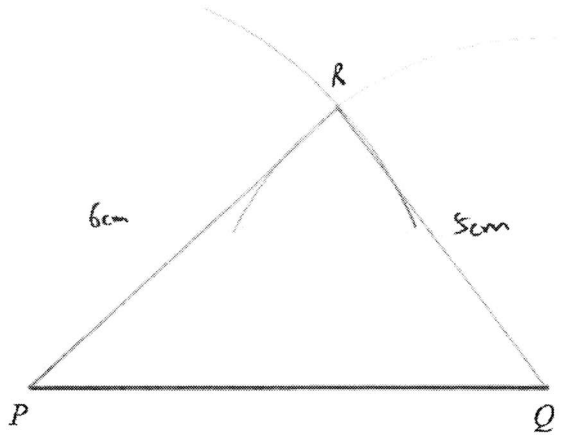
(d) Min Shi has a budget of \$220 to buy 2 child ticket and 4 adult tickets.
Do you think she has enough to buy the tickets?
Justify your answer with appropriate workings.

Answer .....

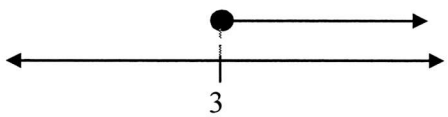
..... [2]

End of Paper

2023 EOY 2NA Mathematics Paper 1 Marking Scheme

1.	$\frac{3x}{4}+\frac{5x+2}{2}=\frac{3x}{4}+\frac{10x+4}{4}$ $=\frac{26x+8}{8}$ $=\frac{13x+4}{4}$ Marker's i/p: Must reduce to lowest terms and simplify to last step		[M1] [A1]
2.	**(a)**		[B1] No mark is awarded if there are no arcs drawn.
	(b)	$\angle QRP = 85°$	[B1] Accepted $83°to86°$
3.	**(a)**	$y=\frac{k}{x^3}$ Sub $x=2, y=16$ $16=\frac{k}{8}$ $k=128$ $y=\frac{128}{x^3}$	[M1] [A1]
	(b)	Sub $x=4$, $y=\frac{128}{4^3}$ $y=\frac{128}{64}$ $=2$	[B1]

4.	**(a)**	$\frac{5x^4y}{25xy^5}=\frac{x^3}{5y^4}$	[B1]
	(b)	$\frac{5x^3}{x}\times\frac{1}{10x}=\frac{x}{2}$	[B1: numerator] [B1: denominator]
5.	**(a)**	12 days → 4 workers 8 days → 6 workers	[M1] [A1]
	(b)	All workers are uniform; have the same rate of working. OR More workers mean they are able to get the work done faster.	[B1]
6.		$3x-y=6$ .....(1) $x+y=1$.....(2) From(1), y = 3 x− 6*orFrom*(2), $x=1-y$*ory* = $1-x$ Marker 's input : Students need to do topical revision as they are not able to recall the steps. (1) + (2), $3x-y+x+y=6+1$ $4x=7$ $x=\frac{7}{4}$ $x=1\frac{3}{4}$ $y=1-\frac{7}{4}$ $y=-\frac{3}{4}$	[M1] Substitution or Elimination method is allowed. [A1] [A1]
7.	**(a)**	P(even number) = $\frac{10}{20}$ = $\frac{1}{2}$	[B1]

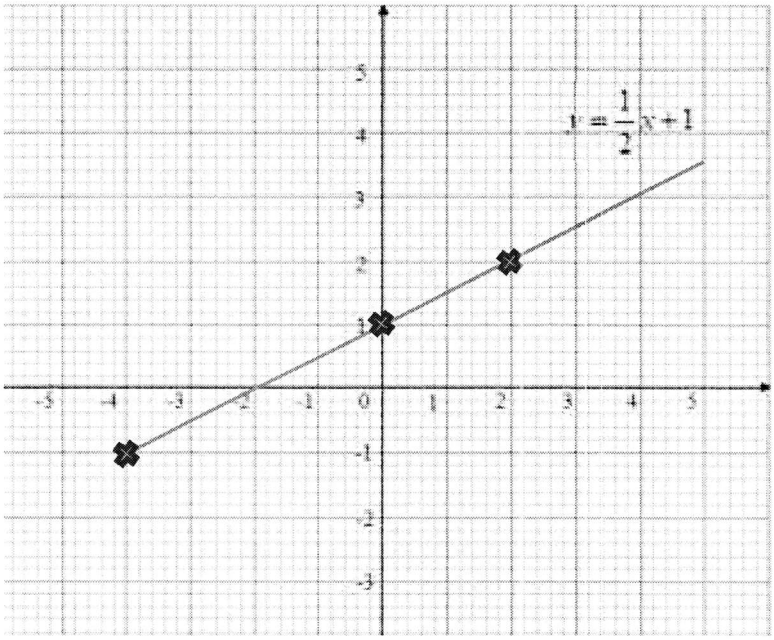
	(b)	P(greater than 6 smaller than 12) $= \frac{5}{20}$ $= \frac{1}{4}$	[B1]
	(c)	P(prime number) $= \frac{8}{20} = \frac{2}{5}$ Marker's input: Question 7 was attempted poorly.	[B1]
8.	**(a)**	$\angle CDE = 180° - 50° - 83°$ $= 47°$	[B1]
	(b)	$\angle EDF = 180° - 57° - 57°$ $= 66°$	[B1]
	(c)	$\angle ADF = 180° - 50° - 47° - 66°$ $= 17°$	[M1] [A1]
9.	**(a)**	$(a+3)(4+2a) = 4a + 12 + 2a^2 + 6a$ $= 2a^2 + 10a + 12$	[M1] [A1]
	(b)	$3(3n-4)^2 = 3(9n^2 - 24n + 16)$ $= 27n^2 - 72n + 48$ Marker's input: Students not able to recall BODMAS rule	[M1] Marks are not awarded if signs are incorrect or missing [A1]
10.	**(a)**	$-3x \leq -8 - 1$ $-3x \leq -9$ $x \geq 3$ Marker's input: Many students made errors in converting the sign.	[M1] [A1]
	(b)	 	[B1]
	(c)	3	[B1]

11.	**(a)**	$Volume of cone = \frac{1}{3}\pi r^2 h$ $= \frac{1}{3}\pi(6)^2(11.5)$ $= 433.53979$ $\approx 434 cm^3$	[M1] [A1]
	(b)	*By Pythagoras Thoerm,* $l^2 = 11.5^2 + 12^2$ $l = \sqrt{(11.5^2 + 12^2)}$ $l = 16.621$ $l \approx 16.6 cm (3sf)$ Marker's input: Many students were not able to do 3s.f. Markers were still awarded.	[M1] [A1]
12.	**(a)**	$\frac{CA}{RP} = \frac{AB}{PQ}$ $\frac{CA}{8.49} = \frac{7.5}{11.25}$ $CA = 5.66 cm$ Marker's input: Many students were not able to do 3s.f. Markers were still awarded. Similar triangle not Pythagoras theorem. No topical revision done.	[M1] [A1]
	(b)	$\angle BCA = 80°$ $\angle BAC = (180 - 48 - 80)°$ $= 52°$	[M1] [A1]
13.	**(a)**	$\frac{1}{2}(y+1) - 6 = 0$ $\frac{1}{2}y + \frac{1}{2} = 6$ $\frac{1}{2}y = 6 - \frac{1}{2}$ $\frac{1}{2}y = 5\frac{1}{2}$ $y = 11$	[M1] [A1]

	(b)	$\frac{x+1}{2}=\frac{5x-2}{4}$ $4(x+1)=2(5x-2)$ $4x+4=10x-4$ $10x-4x=4+4$ $6x=8$ $x=\frac{4}{3}$ $=1\frac{1}{3}$	[M1] [A1]
14.	**(a)**	Volume $=\frac{1}{3}\times basearea\times height$ $=\frac{1}{3}\times 12\times 9\times 15$ $=540\ \text{cm}^3$	 [M1] [A1]
	(b)	$AG^2=6^2+15^2$ $AG=\sqrt{6^2+15^2}$ $=\sqrt{261}$ $=16.155$ $\approx 16.2cm$	[M1] [A1]
	(c)	Total surface area $=(12\times 9)+2(\frac{1}{2}\times 17\times 12)+2(\frac{1}{2}\times 9\times\sqrt{261})$ $=108+204+9\sqrt{261}$ $=457.399$ $\approx 457cm^2$	[M2] [A1]

5(b)	$BC = 17$ cm	B1
6(a)	4 cm : 1 km 4 : 100000 1 : 25000	B1
6(b)	4 cm : 1 km 16 cm^2 : 1 km^2 32 cm^2 : 2 km^2	M1 for finding area scales A1
7(a)	$AC = \sqrt{41^2 - 9^2}$ $= 40$ cm	M1 o.e A1
7(b)	$PR^2 + RQ^2 = 18^2 + 10^2$ $= 424$ $PQ^2 = 20^2$ $= 400$ Since $PR^2 + RQ^2 \neq PQ^2$, by converse of Pythagoras' theorem, triangle PQR is not a right-angled triangle.	M1 for finding both sides A1 must state "by converse of.."
8(a)	283 visitors	B1
8(b)	241 visitors	B1
8(c)	263 visitors	B1
8(d)	$\text{Median} = \frac{264 + 266}{2}$ $= 265$ visitors	B1
8(e)	There are **only 30 data/days/numbers** in the stem-and-leaf diagram but October has 31 days.	B1
8(f)	$\frac{6}{30} \times 100\% = 20\%$	B1

9(a)	$\text{Volume} = \frac{4}{3}\pi r^3$ $= \frac{4}{3}\pi(1.5)^3$ $= 14.137$ $\approx 14.1 \text{ cm}^3$	M1 for correct volume formula A1
9(b)	$\text{Total area} = 3\pi r^2$ $= 3\pi(1.5)^2$ $= 21.206$ $\approx 21.2 \text{ cm}^2$	M1 for correct area formula A1
9(c)	Total cost of 1 hemispherical chocolate $= \frac{1}{2} \times 14.137 \times 0.1 + 21.206 \times 0.20$ $= 4.94805$ $\approx \$4.95$ Selling Price $= \$4.95$ (Accept any answer more than \$4.94.)	M1 for finding cost of chocolate M1 for finding cost of gold foil A1 for any selling price >\$4.94

10(a)	x | -4 | 0 | 2 y | -1 B1 | 1 | 2 B1	
10(b)		M1 Points plotted correctly M1 line drawn correctly
10(c)	$y = 0$	B1 Line drawn in (b) must be correct.
10(d)	Gradient $= \frac{1}{2}$	B1
11(a)	$x + y = 65$	B1
11(b)	$3x + 2y = 150$	B1
11(c)	$x + y = 65$ ---- (1) $3x + 2y = 150$ ---- (2) $(1) \times 2$: $2x + 2y = 130$ ---- (3) $(2) - (3)$: $x = 20$	Both elimination and substitution method are accepted M1 reducing to one linear equation M1 finding x or y

	Sub $x = 20$ into (1) $20 + y = 65$ $y = 65 - 20$ $= 45$ $x = 20, y = 45$	A1
11(d)	$2x + 4y = 2(20) + 4(45)$ $= \$220$ Yes, as the **total cost** of 2 child tickets and 4 adult tickets is **$220**.	M1 A1