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FAJAR SECONDARY SCHOOL
2021 END-OF-YEAR EXAMINATIONS
SECONDARY 2 EXPRESS

CANDIDATE NAME					
CLASS				INDEX NUMBER	

MATHEMATICS 4048/01

Paper 1 **4 October 2021**

Setter: Tan Yiling **1 hour 15 minutes**

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.
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** 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 50.

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Total	/50

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This document consists of **12** printed pages and **0** blank pages.

Mathematical Formulae

Compound interest

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

Mensuration

Curved surface area of a cone = πrl

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

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

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

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

Arc length = $r\theta$, where θ 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

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

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

Answer **all** the questions.

1 The word "RESPONSIBILITY" is made up of 14 letters.
If a letter from "RESPONSIBILITY" is selected randomly, calculate the probability of

(a) selecting the letter "S",

Answer ..... [1]

(b) selecting the letter "A".

Answer ..... [1]

---

2 Simplify

(a) $\frac{6x}{5t} \div \frac{3x^2y}{10t^2s}$

Answer ..... [2]

(b) $\frac{3}{(a-4)} - \frac{2a}{(a-4)^2}$

Answer ..... [2]

---

3 Factorise completely

(a) $8xy - 28y - 6x + 21$

Answer ..... [2]

(b) $6x^2 - 2x - 8$

Answer ..... [2]

---

4 The mass, M grams, of a model car is directly proportional to the cube of its length, l centimetres.

When the length is 3 cm, its mass is 12 g.

(a) Find a formula for M in terms of l.

Answer ..... [2]

(b) Find the length of the model car when its mass is 324 g.

Answer .....cm [1]

---

5 The stem-and-leaf diagram shows the Science test scores of 15 students.

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

Key: 1 | 7 means 17 marks

Find

(a) the modal mark,

Answer ..... [1]

(b) the median mark.

Answer ..... [1]

(c) **(i)** Explain why a dot diagram is not a good choice to organise the above data.

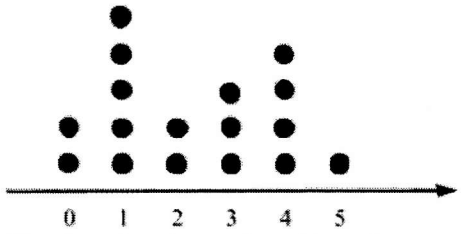
Answer ..... [1]

.....

(ii) Suggest another suitable statistical diagram to present the test scores.

Answer ..... [1]

6 During a study on plant reproduction, same amount of seeds are scattered in each of the pots. The dot diagram represents the number of seeds that germinate in each pot.



Number of seeds germinated in each pot

(a) How many pots are used in this study?

Answer ..... [1]

(b) Find the mean number of seeds germinated in each pot.

Answer ..... [2]

---

7 Rearrange the formula $y = \frac{xz + 2x}{z - 5}$ to make z the subject.

Answer $z =$ ..... [3]

---

8 Solve the simultaneous equations.

$$x + 3y = 23$$
$$2x + 4y = 30$$

Answer $x =$ .....

$y =$ ..... [3]

---

9 **(a)** Solve the inequality $\frac{x+4}{13} \geq \frac{1}{2}$

Answer ..... [2]

(b) Write down the least possible integer value for x.

Answer $x =$ ..... [1]

---

10 **(a)** The number of visitors in the zoo for a day is given as 5000, correct to nearest hundred.
Write down the minimum number of visitors that could be in the zoo for that day.

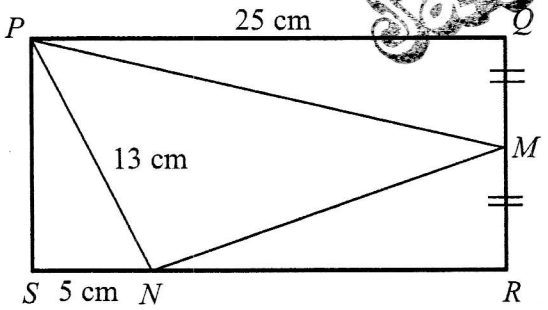
Answer ..... [1]

(b) Karen runs an animal rescue organisation.
69 of the volunteers are men and 38 are women.
Her target is to have at least 75% of the volunteers to be men.

Work out the smallest number of men that would need to join this charity drive in order to achieve her target.

Answer ..... [3]

11 In the rectangle $PQRS$, $PQ = 25$ cm and M is the midpoint of QR. N is a point on RS such that $NS = 5$ cm and $PN = 13$ cm.



(a) Write down the value of

(i) $\cos \angle PNS$,

Answer ..... [1]

(ii) $\tan \angle MNR$.

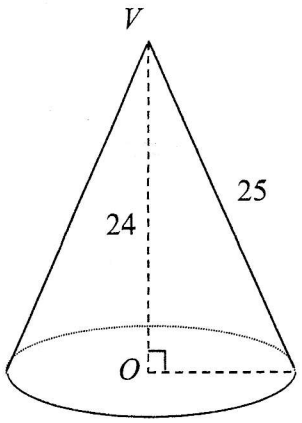
Answer ..... [2]

(b) Calculate angle QPM.

Answer ..... [1]

[Turn over

12 The height of a right circular cone is 24 cm and its slant height is 25 cm.



Find

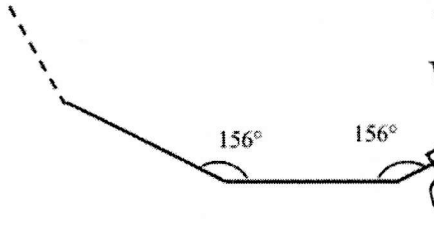
(a) the radius of the cone,

Answer .....cm [1]

(b) the total surface area of the cone.

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

13 **(a)** The diagram shows part of a regular polygon.
How many sides does this polygon has?



Answer ..... [2]

(b) Find the exterior angle of a regular octagon.

Answer ..... [1]

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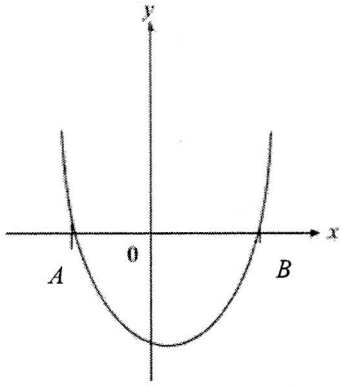
14 The curve $y = x^2 - 3x - 18$ cuts the x-axis at A and B.



Write down the coordinates of A and B.

Answer $A = (\ldots\ldots, \ldots\ldots)$

$B = (\ldots\ldots, \ldots\ldots)$ [4]

---

15 **(a)** Simplify $(2y+3)^2-9$

Answer ..... [2]

(b) Given that y is an integer, determine if $(2y+3)^2-9$ is a multiple of 4.
Show your working clearly.

Answer .....

..... [1]

END OF PAPER

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FAJAR SECONDARY SCHOOL
2021 END-OF-YEAR EXAMINATIONS
SECONDARY 2 EXPRESS

CANDIDATE NAME				
CLASS			INDEX NUMBER	

MATHEMATICS 4048/02

Paper 2 **7 October 2021**

Setter: Tan Yiling **1 hours 15 minutes**

Candidates answer on the Question Paper.

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Answer **all** the questions.

1 Solve the following equations.

(a) $\dfrac{10}{x+1} = 2$

Answer ..... [2]

(b) $\dfrac{2x-1}{2} + \dfrac{2x}{3} = 1$

Answer ..... [3]

2 A bag contains 8 red sweets, 12 green sweets and 4 blue sweets.

Find, in simplest form, the probability that

(a) **(i)** a green sweet is chosen,

Answer ..... [1]

(ii) the sweet chosen is not red.

Answer ..... [1]

(b) How many more blue sweets must be placed in the bag so that the probability of choosing blue sweets would be $\frac{1}{3}$?

Answer ..... [2]

3 The force, F Newtons, exerted by a magnet on a metal object is inversely proportional to the square of the distance, d cm, between them.
When the object is 3 cm away, the force exerted by the magnet is 30 Newtons.

(a) Form an equation connecting F and d.

Answer ..... [2]

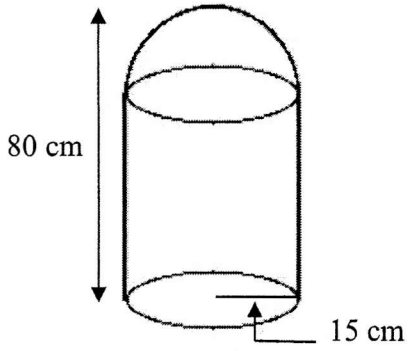
(b) Find the force of the magnet when the distance between them is 5 cm.

Answer ..... N [1]

(c) If the original distance of the magnet and metal object is reduced by 20%, find the ratio of the new force of the magnet to its original force of the magnet.

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

4 The figure below show a container that will be used to store helium gas. It is made up of a cylinder with a hemisphere of radius 15 cm.
The total height of the container is 80 cm.



(a) **(i)** Find the total surface area of the container, in terms of π.

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

(ii) Calculate the cost of painting the outside of the tank if it cost \$23.50 to paint 100 cm^2 of the container. Give your answer correct to the nearest cents.

Answer \$ ..... [1]

(b) Calculate the volume of the container.

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

5 Xavier and Yvonne joined a 8 km walkathon together.

(a) Yvonne completed the walkathon at the constant speed of x km/h.
Write down, in terms of x, the time in hours that Yvonne took to complete the 8 km walk.

Answer ..... hours [1]

(b) Xavier completed the walkathon at a constant speed of $(x+2)$ km/h.
Write down, in terms of x, the time in hours that Xavier took to complete the 8 km walk.

Answer ..... hours [1]

(c) Given that Xavier finished the entire journey 20 minutes earlier than Yvonne, form an equation in x and show that it reduces to $x^2 + 2x - 48 = 0$

[3]

(d) Solve the equation $x^2 + 2x - 48 = 0$.

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

(e) Hence find the total time taken by Yvonne to complete the 8 km walkathon in hours and minutes.

Answer ..... hours ..... minutes [1]

---

6 The table below is for $y = 3 - 5x - 2x^2$.

x	-4	-3	-2	-1.5	-1	0	1
y	-9	0	5	6	6	3	k

(a) Calculate the value of k.

Answer $k =$ ..... [1]

(b) Using a scale of 2 cm to represent 1 unit on the x-axis, draw a horizontal x-axis for $-4 \leq x \leq 1$.
Using a scale of 1 cm to represent 1 unit on the y-axis, draw a vertical y-axis for $-9 \leq y \leq 6$.
On the grid, draw the graph of $y = 3 - 5x - 2x^2$. [3]

(c) Use your graph to find

(i) the coordinates of the maximum point of the graph,

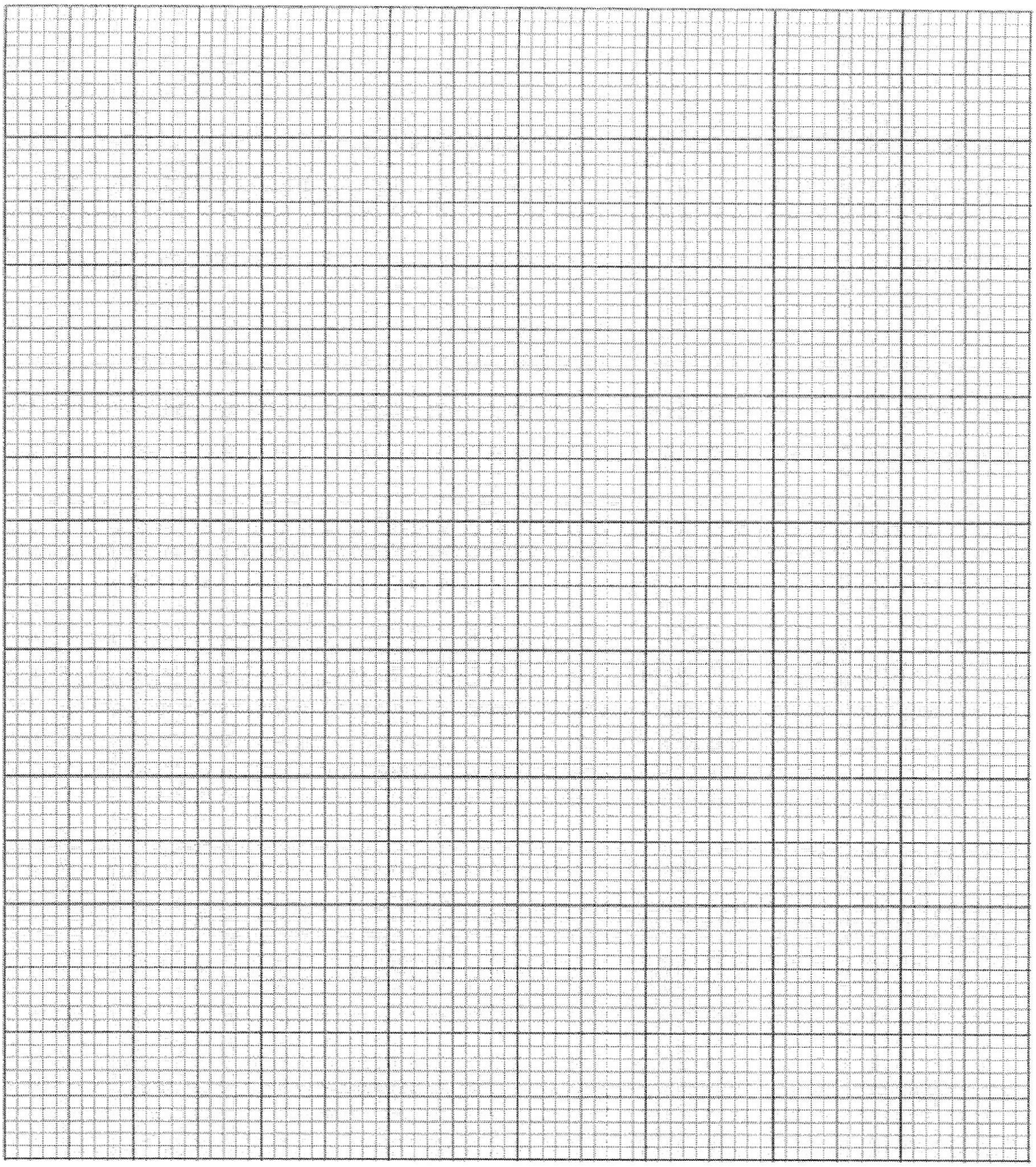
Answer (..... , ...) [1]

(ii) the equation of the line of symmetry

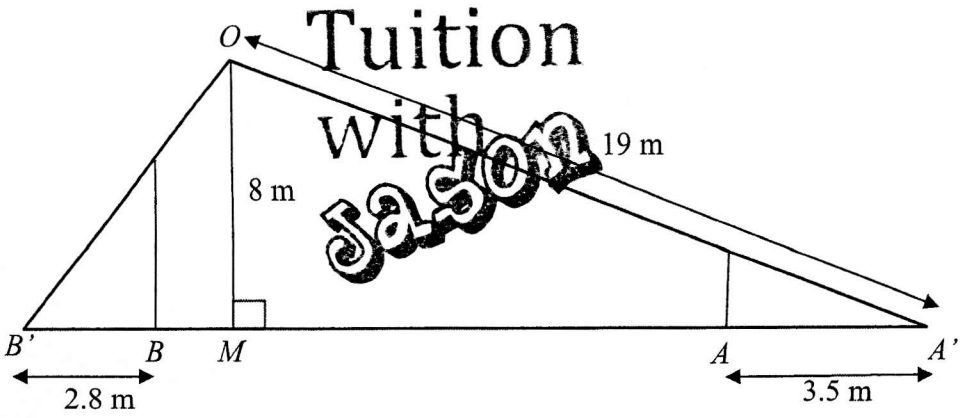
Answer ..... [1]

(d) Find the values of x when $y = 2$

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



7. A spotlight is placed at the top of the wall OM. The height of the wall is 8 m.



(a) If Alice stands at point A, a shadow formed is 3.5 m.
The distance between the spotlight at O and the tip of the shadow A' is 19 m.
How far is Alice standing away from the wall?

Answer .....m [2]

(b) Find the height of Alice.

Answer .....m [2]

(c) A flag pole stands at point B, a shadow formed was 2.8 m.
Given that the height of the flagpole is 5.4 m, find how far Alice is standing away from the flagpole.

Answer .....m [3]

8 The table below represents the information of the roaming rates ($ per minute) for making voice calls or using short message service (SMS) from that destination between 2 Telcos:

A1 Telco

Countries	Zone	Voice Call (Per Min)		SMS Rate
		Incoming	Outgoing within Local / to Singapore	
Malaysia	1	$0.35	$0.40	$0.31
Brunei	1	$0.35	$0.40	$0.30
Australia / New Zealand	2	$1.50	$3.20	$0.80
Europe / US	3	$2.50	$4.00	$0.90

Moonhub

Countries	Zone	Voice Call (Per Min)			SMS Rate
		Incoming	Outgoing within Local	Outgoing to Singapore	
Asia (Malaysia, Brunei, Indonesia)	1	$0.32	$0.35	$0.50	$0.28
Australia/ New Zealand	2	$1.20	$1.50	$4.00	$0.75
Europe/ US	3	$2.50	$2.50	$5.00	$0.90

Ethan went on a business trip to Australia and uses A1 Telco for this trip. His usage for his Australia trip is as follows:

Incoming calls for 1 hour

Outgoing calls within Australia for 1 hour 15 minutes

Texted 64 SMS

(a) Calculate the total bill Ethan needs to pay for his Australia trip.

Answer $ ..... [2]

[Turn over

(b) Both Telcos are having promotion in the month of February.
A1 Telco is having a 10% off total bill while Moonhub is having a $5 off total bill.

Ethan will be traveling to Brunei for his next business trip in February.
He estimated his usage during his trip as follows:

Incoming calls for 1 hour

Outgoing calls within Brunei for 1 hour 30 minutes

Outgoing calls to Singapore for 45 minutes

Texted 55 SMS

Ethan said that it will be cheaper to use Moon hub for his upcoming trip.

Do you agree with Ethan? Justify your answer.

Answer

[5]

END OF PAPER

Qns	Solution	Marking Scheme
1(a)	$\frac{2}{14}=\frac{1}{7}$	B1
1(b)	0	B1
2(a)	$\frac{6x}{5t}\div\frac{3x^2y}{10t^2s}$ $=\frac{6x}{5t}\times\frac{10t^2s}{3x^2y}$ $=\frac{4ts}{xy}$	M1 A1
2(b)	$\frac{3}{(a-4)}-\frac{2a}{(a-4)^2}$ $=\frac{3(a-4)-2a}{(a-4)^2}$ $=\frac{3a-12-2a}{(a-4)^2}$ $=\frac{a-12}{(a-4)^2}$	M1 A1
3(a)	$8xy-28y-6x+21$ $=4y(2x-7)-3(2x-7)$ $=(4y-3)(2x-7)$	M1 A1
3(b)	$6x^2-2x-8$ $=2(3x^2-x-4)$ $=2(3x-4)(x+1)$	M1 (Working Shown) or if (3x-4)(2x+2) shown A1
4(a)	$M\propto l^3$ $M=kl^3$ When $M=12, l=3$ $12=k(3)^3$ $k=\frac{4}{9}$ $M=\frac{4}{9}l^3$	M1 A1
(b)	$324=\frac{4}{9}l^3$ $l^3=729$ $l=9cm$	B1
5(a)	63	
5(b)	56	
5(ci)	Range of data is too large to be represented in a dot diagram.	B1
5(cii)	Another choice of presentating the data is Histogram.	B1

	3x	-4
x	$3x^2$	-4x
1	3x	-4

6(a)	17	B1
6(b)	$\text{Means} = \dfrac{(2\times0)+(5\times1)+(2\times2)+(3\times3)+(4\times4)+(1\times5)}{17}$ $= 2.29$ (to 3 s.f)	M1 A1
7	$y = \dfrac{xz+2x}{z-5}$ $y(z-5) = xz+2x$ $yz-5y = xz+2x$ $yz-xz = 5y+2x$ $z(y-x) = 5y+2x$ $z = \dfrac{5y+2x}{y-x}$	 M1 M1 A1
8	$x+3y = 23$ ..... (1) $2x+4y = 30$ ..... (2) (1) X 2 $2x+6y = 46$ ..... (3) (3) – (2) $2y = 16$ $y = 8$ Sub y = 8 into (1) $x+3(8) = 23$ $x+24 = 23$ $x = -1$ From (1) $x = 23-3y$.....(3) Sub (3) into (2) $2(23-3y)+4y = 30$ $46-6y+4y = 30$ $-2y = -16$ $y = 8$ Sub y = 8 into (3) $x = 23-3(8)$ $x = -1$	 M1 (for correct substitution or shown correct step to eliminate) A1 (y value) A1(x value)
9(a)	$\dfrac{x+4}{13} \geq \dfrac{1}{2}$ $2(x+4) \geq 13$ $x+4 \geq 6.5$ $x \geq 2.5$	 M1 A1
9(b)	$x = 3$	B1
10(a)	4950	B1
10(b)	Let x be the smallest number of men that would need to join. $\dfrac{69+x}{69+38+x} = \dfrac{75}{100}$ $\dfrac{69+x}{107+x} = \dfrac{3}{4}$ $4(69+x) = 3(107+x)$ $276+4x = 321+3x$ $x = 45$	 M1 (forming the correct equation) M1 A1

11(ai)	$\cos \angle PNS = \frac{5}{13}$	B1
11(aii)	$PS = \sqrt{13^2 - 5^2}$ $PS = 12$ $MR = 6$ cm NR = 20 cm $\tan \angle MNR = \frac{6}{20}$ $= \frac{3}{10}$	M1 (for PS) A1
11(b)	$\angle QPM = \tan^{-1}(\frac{6}{25})$ $= 13.5°$	B1
12(a)	Radius = $\sqrt{25^2 - 24^2}$ $= 7$ cm	B1
12(b)	Total surface area = $\pi rl + \pi r^2$ $= \pi \times 7 \times 25 + \pi \times 7^2$ $= 703.717$ $\approx 704 cm^2$	M1 A1
13(a)	$(n-2) \times 180 = 156n$ $180n - 360 = 156n$ $180n - 156n = 360$ $24n = 360$ $n = 15$	M1 (Or using exterior angle) A1
13(b)	$360° \div 8 = 45°$	B1
14	$y = x^2 + 3x - 18$ $y = (x+3)(x-6)$ At $y = 0$ $(x+3)(x-6) = 0$ $x = -3$ or $x = 6$ A=(-3, 0) B=(6, 0)	M1 M1 A1 A1
15(a)	$(2y+3)^2 - 9$ $= (2y+3+3)(2y+3-3)$ $= (2y+6)(2y)$ $= 4y^2 + 12y$	M1 A1
15(b)	$4y^2 + 12y$ $= 4(y^2 + 3y)$	M1 A1

	Since (y^2+3y) is always an integer, $4(y^2+3y)$ will always be a multiple of 4.	

Qns	Solution	Marking Scheme
1(a)	$\frac{10}{x+1}=2$ $2(x+2)=10$ $x+2=5$ $x=3$	M1 (Cross multiply) A1
(b)	$\frac{2x-1}{2}+\frac{2x}{3}=1$ $\frac{3(2x-1)+4x}{6}=1$ $\frac{6x-3+4x}{6}=1$ $10x-3=6$ $10x=9$ $x=\frac{9}{10}$	M1 (Express as single fraction) M1(10x-3) shown A1
2(ai)	$\frac{12}{24}=\frac{1}{2}$	B1
(aii)	$1-\frac{8}{24}=\frac{16}{24}$ $=\frac{2}{3}$	B1
(b)	Let x be the amount of blue that need to be added. $\frac{x+4}{x+24}=\frac{1}{3}$ $3(x+4)=x+24$ $3x+12=x+24$ $2x=12$ $x=6$	M1 A1
3a	$F=\frac{k}{d^2}$ $30=\frac{k}{3^2}$ $k=30\times 9$ $k=270$ $\therefore F=\frac{270}{d^2}$	M1 A1
3b	$F=\frac{270}{5^2}$ $F=10.8N$	B1

3c	$F_1 = \dfrac{k}{(0.8d)^2}$ $F_1 = \dfrac{k}{\frac{16}{25}d^2}$ $F_1 = \dfrac{25}{16}(\dfrac{k}{d^2})$ $F_1 = \dfrac{25}{16}F$ F_1 : F 25 : 16	M1 (Showing 0.8d) A1
4(ai)	Total surface area of container $= \dfrac{1}{2} \times 4\pi r^2 + 2\pi r h + \pi r^2$ $= 2\pi(15)^2 + 2\pi(15)(80-15) + \pi(15)^2$ $= 450\pi + 1950\pi + 225\pi$ $= 2625\pi$ cm^2	M2 (M1 for any 2 correct formula with correct input of values) A1
(aii)	Total cost $= (2625\pi \div 100) \times 23.50$ $= \$1937.97$ to nearest cents	B1
(b)	Total volume of container $= \pi r^2 h + \dfrac{1}{2} \times \dfrac{4}{3}\pi r^3$ $= \pi(15)^2(80-15) + \dfrac{1}{2} \times \dfrac{4}{3}\pi(15)^3$ =53 014.37 ≈53 000 cm^3 to 3 sig fig	M1 A1
5(a)	Time taken by Yvonne $= \dfrac{8}{x}h$	B1
(b)	Time taken by Xavier $\dfrac{8}{x+2}h$	B1
(c)	$\dfrac{8}{x} - \dfrac{8}{x+2} = \dfrac{1}{3}$ $\dfrac{8(x+2)-8x}{x(x+2)} = \dfrac{1}{3}$ $16(3) = x(x+2)$ $48 = x^2 + 2x$ $x^2 + 2x - 48 = 0$ *Shown*	M1 M1 (Cross Multiply) A1
(d)	$x^2 + 2x - 48 = 0$ $(x+8)(x-6) = 0$ $x = -8$ (rej) or $x = 6$	M1 A1

	Time taken by Yvonne $= \frac{8}{6} = 1hr 20\min s$	A1
7(a)	$MA' = \sqrt{19^2 - 8^2}$ $= 17.234$ m $MA = 17.234 - 3.5$ $= 13.734$ ≈ 13.7 m (to 3 s.f.)	M1 (finding MA') A1
(b)	$\sin \angle OA'M = \frac{8}{19}$ $\angle OA'M = 24.9°$ $\tan 24.9° = \frac{h}{3.5}$ $h = 1.6246$ $h \approx 1.62$ m (to 3 s.f.)	M1 A1
(c)	$\tan \angle OB'M = \frac{5.4}{2.8}$ $\angle OB'M = 62.59°$ $\tan 62.59° = \frac{8}{B'M}$ $B'M = 4.1486m$ Distance between Bernard and Alice $= 4.1486 - 2.8 + 13.7\,34$ $= 15.08$ $= 15.1$ m (to 3 s.f.)	M1 (finding B'M) M1 A1
6(a)	$k = -4$	B1
6(b)		M1 (All points plotted correctly) M1 (Smooth curve) M1 (Correct axes drawn)
c(i)	(-1.25, 6.1)	B1 ± 0.05 for y value
c(ii)	$x = -1.25$	B1
d	$X = -2.65$ *or* $x = 0.2$	B1 (± 0.05 for x value)
8(a)	Total cost = 60($1.50)+75($3.20)+ 64($0.80) = $381.20	M1 A1
(b)	A1 Total cost = 60($0.35)+90($0.40)+45($0.40)+55($0.30) = $91.50 Price after discount = $91.50 ×0.9 = $82.35 Moonhub Total cost = 60($0.32)+90($0.35)+45($0.50)+55($0.28) = $88.60 Price after discount = $88.60 - $5 = $83.60 I disagree with Ethan as it is $1.25 cheaper to use A1 Telco.	M1 M1 M1 M1 A1
