WOODLANDS RING SECONDARY SCHOOL

Name : _____ Reg No. _____ Class : _____

EXAMINATION	:	**END-OF-YEAR EXAMINATION**	
LEVEL	:	**SECONDARY 2 EXPRESS**	**DATE: 02 Oct 2018**
SUBJECT	:	**MATHEMATICS**	**PAPER: 1**
DURATION	:	**1 hour 15 minutes**	**MAX MARKS: 50**
SETTER(S)	:	**Mrs Oh Mei Ting**	**Parent's/Guardian's Signature:**

INSTRUCTIONS TO CANDIDATES

Write your name, class and register number on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

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

For Examiner's Use	
Strand	Marks
1. Arithmetic (Questions 1 – 3, 5)	/ 11
2. Statistics and Probability (Questions 9, 14)	/ 9
3. Algebra (Questions 4, 8, 12)	/ 12
4. Geometry and Mensuration (Questions 6 – 7, 10 – 11, 13)	/ 18
TOTAL MARKS	**50**

This paper consists of 13 printed pages including the cover page.

Mathematical Formulae

Mensuration

Curved surface area of a cone = πrl

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

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

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

Statistics

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

1 Given that $2^4 \times 17^2 = 4624$, find $\sqrt{4624} \times \sqrt[3]{15\frac{5}{8}}$.

Show your working clearly.

Answer ..... [2]

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2 The numbers, P, Q and R, expressed as products of their prime factors are given below.

$P = 2^2 \times 3 \times 5^3 \times 11^5$
$Q = 2 \times 5^4 \times 7^2 \times 11^3$
$R = 2^3 \times 3^5 \times 11^2$

Find, in **index notation**, the

(a) lowest common multiple of P, Q and R,

Answer ..... [1]

(b) largest whole number that is a factor of P, Q and R,

Answer ..... [1]

(c) smallest value of x such that xPQ is a perfect square.

Answer ..... [1]

---

3 Given the following list of numbers,

$$\sqrt[3]{-64},\ 0.\dot{4},\ \pi,\ 0,\ 2\sin 90° + \tan 45°,\ 0.3648$$

list all the

(a) integer(s),

Answer ..... [1]

(b) prime number(s),

Answer ..... [1]

(c) irrational number(s).

Answer ..... [1]

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4 The braking distance, d metres, of a car is proportional to the square of its speed, v km/h.

(a) The braking distance for a car travelling at 80 km/h is 51.2 m.
Find the formula connecting d and v.

Answer ..... [2]

(b) Find the braking distance when this car is travelling at 120 km/h.

Answer ..... m [1]

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5 The diagram shows the travel itinerary of Tom's return flight for his Singapore-Melbourne trips.

FLIGHT	DEPARTURE	ARRIVAL
TZ 86 Scoot	**Singapore (SIN)** 05 Apr 2018 01:15am	**Melbourne (MEL)** 05 Apr 2018 10:35am
TZ 87 Scoot	**Melbourne (MEL)** 04 May 2018 11:20am	

For both trips, the duration of the flight is the same.
The time in Melbourne is 2 hours ahead of Singapore time.

(a) Calculate the duration of the flight from Singapore to Melbourne.
Give your answer in hours and minutes.

Answer ..... h ..... min [1]

(b) On 4 May, Tom was supposed to have a dinner appointment with his colleague at Vivo City, Singapore at 7.00 pm.

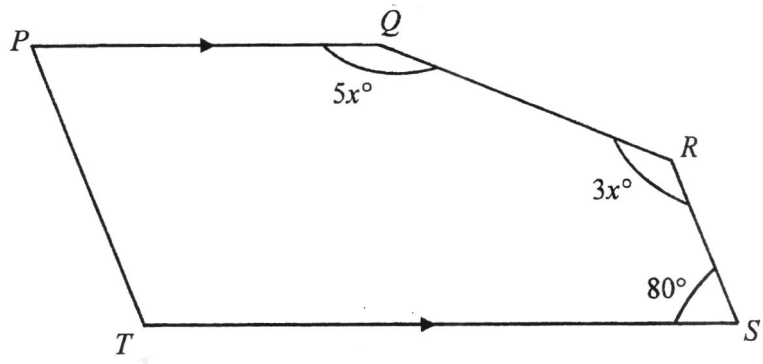
Assuming that the travelling time from Changi Airport to Vivo City was not more than 40 minutes by car, determine if Tom was able to make it for the dinner.
Justify your answer with clear reasoning and working.

Answer .....

.....

..... [2]

6 In the diagram shown below, $PQRST$ is a pentagon. PQ is parallel to TS.
$\angle TSR = 80°$, $\angle PQR = 5x°$ and $\angle QRS = 3x°$.



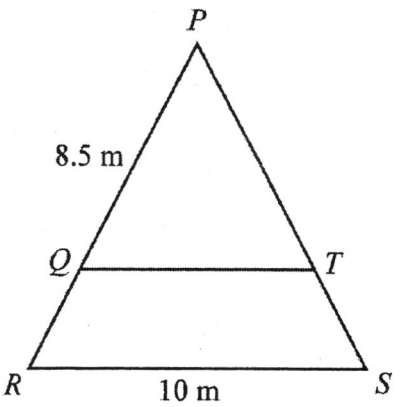
(a) Find the sum of interior angles of a pentagon.

Answer ..... ° [1]

(b) Find the value of x.

Answer ..... [2]

7 ΔPQT is similar to ΔPRS. It is given that $PQ = 8.5$ m and $RS = 10$ m.



Given that the ratio of the length of $QT : RS$ is $13 : 20$, find the length of

(a) QT,

Answer ..... m [1]

(b) QR.

Answer ..... m [2]

---

8 Factorise the following expressions completely.

(a) $9x^2 - 225$

Answer ..... [2]

(b) $3a - 6b + 2bc - ca$

Answer ..... [2]

---

9 There are 8 blue balls and x black balls in a bag.

If the probability of selecting a black ball is $\frac{3}{5}$, find

(a) the total number of balls in the bag,

Answer ..... [2]

(b) the number of additional black balls needed so that the probability of selecting a black ball becomes $\frac{5}{6}$.

Answer ..... [2]

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10 **(a)** Find the acute angle θ for $\cos\theta = 0.35$, giving your answer correct to 1 decimal place.

Answer ..... ° [1]

(b) A student calculates the acute angle θ for $2\sin\theta = 5.61$ and his calculator shows 'math error'. In the space below, explain why this is so.

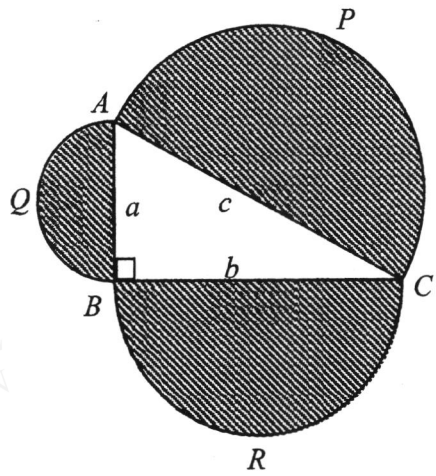
Show your working clearly.

Answer .....

.....

..... [2]

11 In the diagram, ABC is a right-angled triangle.
A semicircle is constructed on each of the side AB, BC and AC.
It is given that $AB = a$, $BC = b$, $AC = c$.



Show that

Area of semicircle APC = Area of semicircle AQB + Area of semicircle BRC.

Answer [4]

12 **(a)** Subtract $(x+3)^2$ from $(2x-1)^2$. Give your answer in its simplest form.

Answer ..... [2]

(b) Simplify each of the following expressions.

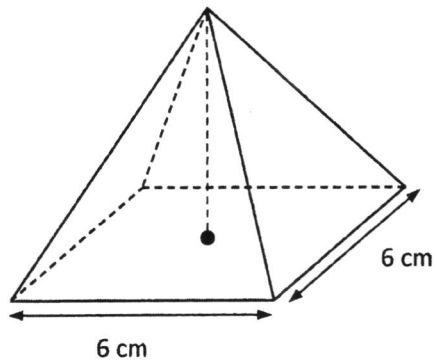
(i) $\dfrac{3x^2y^3}{4xy^4z} \times \dfrac{12}{x}$

Answer ..... [1]

(ii) $\dfrac{x+4}{5} - \dfrac{x-4}{10}$

Answer ..... [2]

13 The diagram below shows a right square pyramid with base dimensions 6 cm by 6 cm.



If it has a volume of 48 cm^3, find its

(a) height,

Answer ..... cm [2]

(b) total surface area.

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

14 The table below shows the amount of pocket money a class of forty students receive each week.

Amount of pocket money in $	15	16	17	18	19	20
Number of students	5	3	x	12	y	5

(a) Given that the mode is \$18, find the largest possible value of x.

Answer ..... [1]

(b) With x taking the largest value from part **(a)**,

(i) find the value of y,

Answer ..... [2]

(ii) hence, calculate the mean amount of pocket money the students receive each week.

Answer \$ ..... [2]

~~ End of Paper ~~

WOODLANDS RING SECONDARY SCHOOL

Name : _____ Reg No. ____ Class : _____

EXAMINATION : END-OF-YEAR EXAMINATION

LEVEL : SECONDARY 2 EXPRESS **DATE: 04 Oct 2018**

SUBJECT : MATHEMATICS **PAPER: 2**

DURATION : 1 hour 15 minutes **MAX MARKS: 50**

SETTER(S) : Mr Ong Chee Lim **Parent's/Guardian's Signature:**

READ THESE INSTRUCTONS FIRST

Write your answers and working on the separate answer papers provided.
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 pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.
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Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.
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For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

For Examiner's Use	
Strand	Marks
1. **Arithmetic** (Questions 3)	/ 4
2. **Statistics and Probability**	NA
3. **Algebra** (Questions 1, 2, 4)	/ 27
4. **Geometry and Mensuration** (Question 5, 6, 7)	/ 19
TOTAL MARKS	50

Mathematical Formulae

Mensuration

Curved surface area of a cone = πrl

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

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

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

Statistics

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

Answer ALL questions.

1 **(a)** Express $\frac{3}{x-2}-\frac{1}{x-3}$ as a single fraction in its simplest form. [2]

(b) Solve the simultaneous equations.

$$2x-3y=12$$
$$4x+y=3$$ [3]

(c) Given that $p=\sqrt{\frac{r-2}{3-4r}}$, express r in terms of p. [3]

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2 Rose was given a budget of \$192 to purchase door gifts for her party.

She decided to use the money to buy some mugs.

Shop A is selling the mugs at \$$y$ each.

(a) Find an expression, in terms of y, for the number of mugs she can buy in Shop A. [1]

(b) Shop B is having an opening sales. A mug will cost \$2 cheaper if she is to buy it at Shop B. Write down an expression, in terms of y, for the number of mugs she can buy in Shop B. [1]

(c) If Rose used the \$192 to buy the mugs at Shop B instead of Shop A, she would be able to buy 8 more mugs.

(i) Write down an equation in y to represent this information, and show that it reduces to $y^2-2y-48=0$. [3]

(ii) Solve the equation $y^2-2y-48=0$. [2]

(d) Explain why one of the answers is not acceptable. [1]

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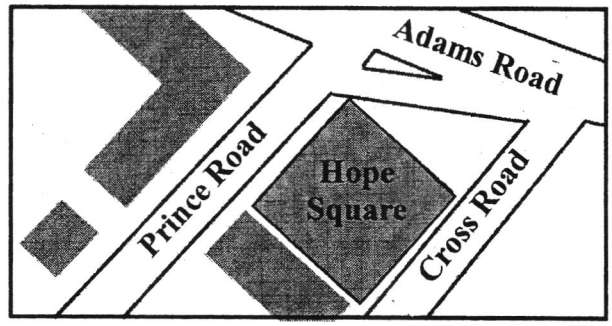
3 The following street map is drawn to scale. The map has a scale of 5 cm : 0.25 km.



(a) Write down the map scale in the form 1 : r. [1]

(b) Find the actual walking distance, in m, between Prince Road and Cross Road if the length on the map is 2.65 cm. [1]

(c) Using the map, estimate the area of Hope Square in m^2. [2]

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4 **Answer the whole of this question on a single sheet of graph paper.**

The variables x and y are connected by the equation $y = -\frac{1}{2}x^2 + 2x - 1$.

Some corresponding values of x and y are given in the table below.

x	–3	–2	–1	0	1	2	3	4
y	–11.5	–7	–3.5	–1	0.5	1	0.5	p

(a) Calculate the value of p. [1]

(b) Using a scale of 2 cm to represent 1 unit, draw a horizontal axis for $-3 \le x \le 4$.
Using a scale of 2 cm to represent 2 units, draw a vertical axis for $-14 \le y \le 2$.
On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Write down the equation of the line of symmetry for the curve. [1]

(d) Using your graph to find

(i) the value of y when $x = -2.5$, [1]

(ii) the maximum value of y. [1]

(e) **(i)** On the same axes, draw the line $y = x - 2$ for $-3 \le x \le 4$. [2]

(ii) Write down the coordinates of intersection points of the line and the curve. [2]

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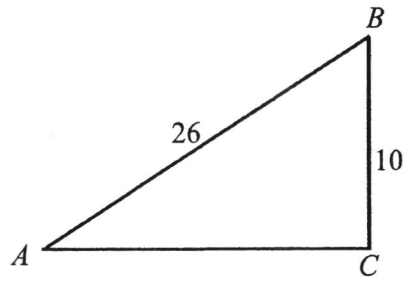
5 In the diagram, BC is perpendicular to AC.



Given that $BC = 10$ cm and $AB = 26$ cm, calculate

(a) $\angle ABC$, [2]

(b) AC, [2]

(c) the shortest distance from C to the line AB. [2]

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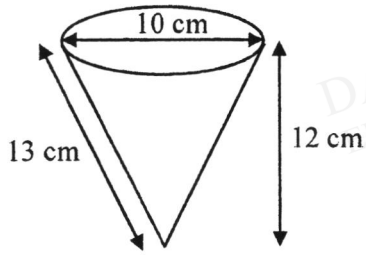
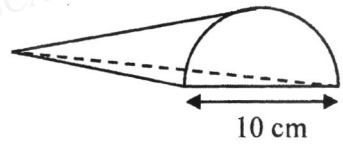
6 A rubber cone of diameter 10 cm, height 12 cm and slant height 13 cm is cut in half to make two rubber door stoppers.





Find

(a) the volume of each rubber stopper, [2]

(b) the surface area of each rubber stopper. [3]

Correct all answers to 3 significant figures.

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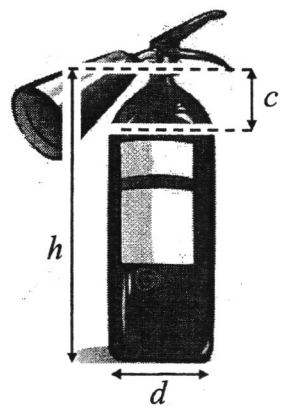
7 Here is some information about a fire extinguisher.

Fire Extinguisher

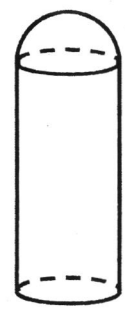
Height (h): 31 cm

Diameter (d): 11 cm

Mass of empty fire extinguisher = 10 kg



In this question, the fire extinguisher can be modelled as a cylinder with a hemisphere on top.



(a) Work out the area, in square centimetres, of the base of the fire extinguisher. [2]

(b) Work out the volume, in cubic centimetres, of the fire extinguisher. [3]

(c) A new fire extinguishing medium, PRQ Powder is being experimented.

Useful Information
Density of PRQ Powder: 12.5 g/cm^3
1 kg is equivalent to 9.8 N.

It is found that the fire extinguisher may explode if the total weight of its contents per square centimetre, acting on the base area of the extinguisher, is greater than 0.2 N/cm^2.

Fire extinguisher bottles are typically filled to 40% of its total volume.

Will the extinguisher explode when filled to 40% of its total volume?

Justify your conclusion with clear calculations.

Hint: You may want to first find out the mass of the powder in the fire extinguisher. [3]

~~ End of Paper ~~

Qn		Answer/Working	Marks/Remarks
1		$\sqrt{4624} \times \sqrt[3]{15\frac{5}{8}}$ $= \sqrt{2^4 \times 17^2} \times \sqrt[3]{\frac{125}{8}}$ $= \sqrt{(2^2 \times 17)^2} \times \sqrt[3]{\left(\frac{5}{2}\right)^3}$ $= 2^2 \times 17 \times \frac{5}{2}$ $= 170$	Many students did not show their working, and most did not show how $\sqrt{15\frac{5}{8}} = 2.5$. Thus, they did not obtain M1. M1 A1 B1 was awarded if student's answer is correct but working is incomplete.
2	(a)	$2^3 \times 3^5 \times 5^4 \times 7^2 \times 11^5$	B1
	(b)	2×11^2	B1
	(c)	$x \times [2^3 \times 3 \times 5^7 \times 7^2 \times 11^2]$ $x = 2 \times 3 \times 5$	B1
	This question was badly done. Observations: ▪ Many students could not remember LCM (lowest common multiple) and HCF (highest common factor, or largest factor of the 3 numbers) ▪ Many students did not read the instruction 'Find, **in index notation**...'		
3	(a)	$\sqrt[3]{-64}$, 0, $2 \sin 90° + \tan 45°$	B1
	(b)	$2 \sin 90° + \tan 45°$	B1
	(c)	π	B1
	This question was badly done. Observations: ▪ Many students could not remember the definitions of integer, prime number or irrational numbers. ▪ Some students did not write down the numbers stated in the list. They gave '–4' or '3' instead. ▪ Some students were careless in their reading and thought there were 2 different numbers 2 sin 90° and tan 45°.		
4	(a)	$d = kv^2$ $51.2 = k(80)^2$ $k = 0.008$ $d = 0.008v^2$ *or* $d = \frac{1}{125}v^2$ *or* $v^2 = 125d$	Many students thought d is proportional to v, instead of v^2. M1 A1
	(b)	$d = 0.008v^2$ $= 0.008(120)^2$ $= 115.2$ Braking distance is 115.2 m	 B1

Qn		Answer/Working	Marks/Remarks
5	(a)	10.35 am in Melbourne = 8.35 am in Singapore Duration from 1.15 am to 8.35 am = 7 h 20 mins	Some students did not subtract 2 h to convert to SG time; a handful added 2 h instead. B1
	(b)	7 h 20 mins after 11.20 am is <u>6.40 pm in Melbourne</u>. 6.40 pm in Melbourne is 4.40 pm in Singapore. **OR** 11.20 am in Melbourne is 9.20 am in Singapore. 7 h 20 mins after 9.20 am is <u>4.40 pm in Singapore</u>. Since the travelling time from Changi Airport to Vivo City was not more than 40 mins, he should reach Vivo City by 5.20 pm. Thus, Tom was able to make it for the dinner at 7.00 pm.	M1 Proper reasons / working must be shown M1 was awarded if students calculated the arrival time correctly. If student's answer for part (a) was wrong, but he/she gave a reasonable conclusion based on his/her correct calculation for (b), then A1 was awarded. A1
6	(a)	Sum of interior angles of a pentagon $=(5-2)\times 180°$ $=540°$	Some students did not remember the formula correctly. B1
	(b)	$5x+3x+80+180=540$ $8x=280$ $x=35$	M1 A1
	Observations: ▪ Some students assumed that PT is parallel to RS and thought that $\angle PTS = 100°$. Hence, 1 mark was deducted for the wrong assumption if the student obtained the correct answer. ▪ M1 was awarded if students recognised that $\angle PTS + \angle TPQ = 180°$ (int $\angle$s, PQ // TS) but obtained the wrong answer.		
7	(a)	$\frac{QT}{RS}=\frac{13}{20}$ (given) $\frac{QT}{10}=\frac{13}{20}$ $QT=10\times\frac{13}{20}$ $=6.5$ or $\frac{13}{2}$ or $6\frac{1}{2}$	Quite a number of students use ratio method to find QT. B1
	(b)	$\frac{8.5}{8.5+QR}=\frac{13}{20}$ $110.5+13QR=170$ $13QR=59.5$ $QR=\frac{59.5}{13}$ $=4\frac{15}{26}$ ≈ 4.58 (3 sig. fig.) **OR**	M1 A1

Qn		Answer/Working	Marks/Remarks
		$\frac{PQ}{PR}=\frac{QT}{RS}=\frac{13}{20}$ (ratio of corr. sides of similar Δs) $\frac{8.5}{PR}=\frac{13}{20}$ $PR=8.5\times\frac{20}{13}$ $=\frac{170}{13}$ or $13\frac{1}{3}$ $QR=PR-PQ$ $=13\frac{1}{13}-8.5$ $=\frac{119}{26}$ or $4\frac{15}{26}$ or 4.58	M1 Some students thought they were to find the length of PR. M1 was awarded if students gave $13\frac{1}{3}$ or 13.1 as the answer. A1
8	(a)	$9x^2-225$ $=(3x)^2-(15)^2$ $=(3x+15)(3x-15)$ * [M1] $=9(x+5)(x-5)$ [A1] $9x^2-225$ $=9(x^2-25)$ [M1] $=9(x+5)(x-5)$ [A1]	Many students did not factorised completely. Some wrongly factorised $(3x+15)(3x-15)$ $=3(x+5)(x-5)$
	(b)	**Method 1** $3a-6b+2bc-ca$ $=3a-ca+2bc-6b$ $=a(3-c)+2b(c-3)$ [M1] $=a(3-c)-2b(3-c)$ $=(3-c)(a-2b)$ [A1] **Method 2** $3a-6b+2bc-ca$ $=3(a-2b)+c(2b-a)$ [M1] $=3(a-2b)-c(a-2b)$ $=(a-2b)(3-c)$ [A1]	Some students did not factorised correctly in the first step: $3a-6b+2bc-ca$ $=3(a-2b)-c(a+2b)$ OR $3a-ca-6b+2bc$ $=a(3-c)-2b(3+c)$
9	(a)	**Method 1** P(select black ball) $=\frac{3}{5}$ $\frac{x}{8+x}=\frac{3}{5}$ $5x=24+3x$ $2x=24$ $x=12$ [M1] total no. of balls in bag $=8+12$ $=20$ [A1] **Method 2** P(blue ball) $=\frac{2}{5}$ $\frac{8}{8+x}=\frac{2}{5}$ [M1] $=\frac{8}{20}$ $\Rightarrow x+8=20$ $\therefore$ Total number of balls = 20 [A1] **Method 3** Black : Total = 3 : 5 Blue : Total = 2 : 5 2u — 8 balls [M1] 5u — 20 balls [A1] Observation: Some students wrongly equated ratio with the absolute value: $\frac{2}{5}=8$ 1 mark was deducted for this wrong concept for part (a) only.	
	(b)	Let y be the additional number of black balls. $\frac{12+y}{20+y}=\frac{5}{6}$ [M1] $72+6y=100+5y$ $y=28$ [A1]	Observation: Some students wrongly denoted the additional no. of black balls with x, which represents the original no. of black balls. Black : Total = 5 : 6 Blue : Black = 1 : 5 1u — 8 balls 5u — 40 balls [M1] Original black = 12 Additional = 40 – 12 = 28 [A1]

Qn		Answer/Working	Marks/Remarks
10	(a)	$\cos\theta = 0.35$ $\theta = \cos^{-1} 0.35$ $= 69.5°$ (1 d.p.) No working, correct answer → no mark awarded	A1
	(b)	$2\sin\theta = 5.61$ $\sin\theta = \frac{5.61}{2}$ must expressed as sin θ and not θ The hypotenuse side must be longer than the opposite side. **OR** $\sin\theta \leq 1$ **OR** max value of $\sin\theta$ is 1 No mark if students wrote **sin^{-1}** should be less than (or equal) to 1.	M1 B1
11		Area of semicircle AQB $= \frac{1}{2}\pi\left(\frac{a}{2}\right)^2$ $= \frac{a^2}{8}\pi$ Area of semicircle BRC $= \frac{1}{2}\pi\left(\frac{b}{2}\right)^2$ $= \frac{b^2}{8}\pi$ Area of semicircle APC $= \frac{1}{2}\pi\left(\frac{c}{2}\right)^2 = \frac{c^2}{8}\pi$ Since $c^2 = a^2 + b^2$ (Pythagoras' Theorem) No mark if students wrote: **$AC^2 = AB^2 + BC^2$** They need to use the **dimension** (a, b and c) given in the question. ∴ Area of semicircle APC $= \frac{a^2 + b^2}{8}\pi$ Area of semicircle AQB + Area of semicircle BRC	M1 for correct expression of area of **either** AQB **or** BRC Observation: Many students were not careful with the formula used for finding area of a semicircle, as well as used of wrong radius (substituted diameter instead). → no mark M1 for correct expression of area of APC M1 for applying Pythagoras' Theorem A1

Qn		Answer/Working	Marks/Remarks
		$= \frac{a^2}{8}\pi + \frac{b^2}{8}\pi = \frac{a^2+b^2}{8}\pi$ $\therefore$ Area of semicircle APC = Area of semicircle AQB + Area of semicircle BRC Observation: ▪ Students need to learn to understand what the question is asking → To **show** how the areas are related instead of using the given relationship directly. ▪ Some students went to show Pythagoras' Theorem ($c^2 = a^2 + b^2$) as their final answer.	
12	(a)	**Method 1** $(2x-1)^2-(x+3)^2$ $=[(2x-1)+(x+3)][(2x-1)-(x+3)]$ $=(3x+2)(x-4)$ $=3x^2-10x-8$ **Method 2** $(2x-1)^2-(x+3)^2$ $=[(2x)^2-2(2x)(1)+1^2]-[x^2+2(x)(3)+3^2]$ $=(4x^2-4x+1)-(x^2+6x+9)$ $=3x^2-10x-8$ Final answer must be written as $3x^2 - 10x - 8$. Some students did not take note of the word '**from**' and got the expression wrong at the start. Common error made → Students wrote $2x^2$ instead of $(2x)^2$. Omission of bracket resulted in the wrong expression → no mark	M1 A1 **OR** M1 A1
	(b)(i)	$\frac{3x^2y^3}{4xy^4z} \times \frac{12}{x}$ $= \frac{9}{yz}$ Did not leave answer in simplest form → no mark	B1

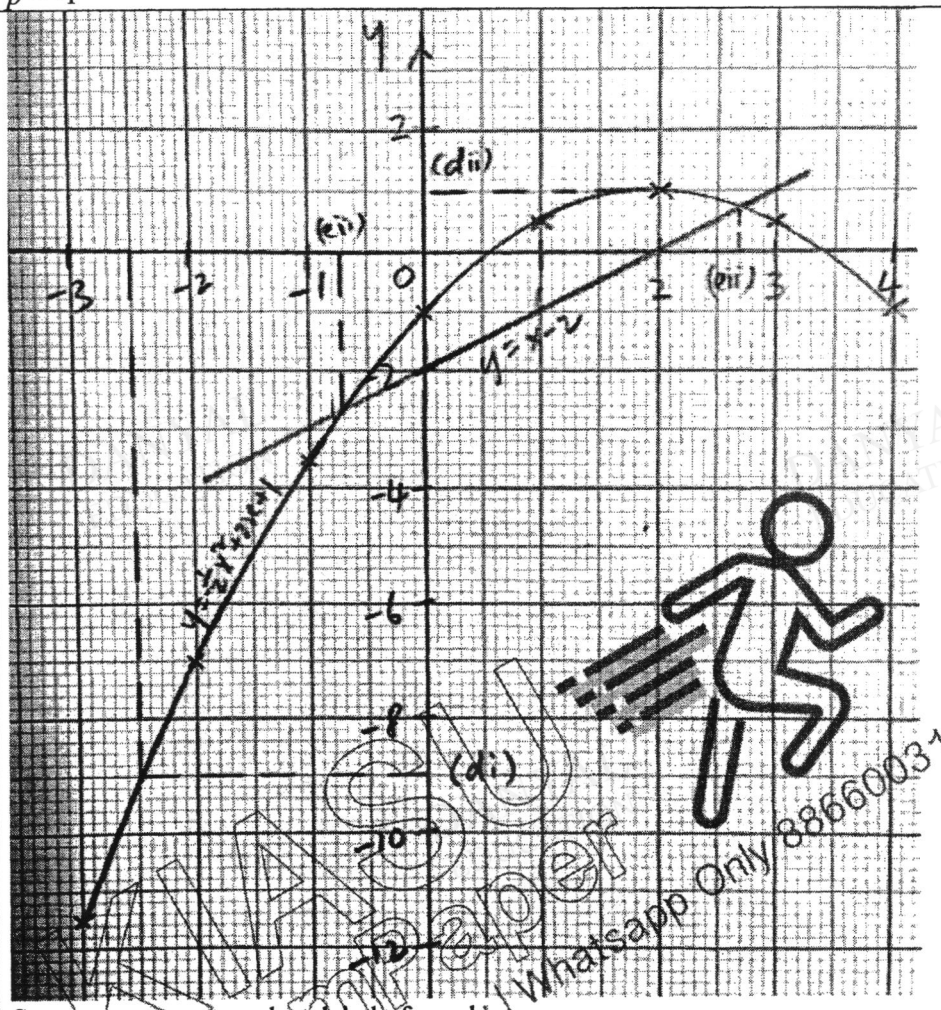
Qn		Answer/Working	Marks/Remarks
	(b)(ii)	$\frac{x+4}{5}-\frac{x-4}{10}$ $=\frac{2(x+4)-(x-4)}{10}$ $=\frac{2x+8-x+4}{10}$ $=\frac{x+12}{10}$ Omission of bracket for $(x-4)$ when simplifying into single fraction → no mark	M1 A1
13	(a)	Volume $=\frac{1}{3}\times$ base area $\times h$ $48=\frac{1}{3}\times 6\times 6\times h$ $\therefore h=4$ cm Wrong formula used (e.g. used the formula for finding volume of sphere/cylinder, omission of $\frac{1}{3}$ or did not write the square when finding the base area) → no mark Observation: Some students need to learn to present their workings clearly using the formula for finding volume of a pyramid. Quite a number of students split their workings (chunking).	M1 A1
	(b)	Using Pythagoras' Theorem, Let the slant height be l. $l^2=3^2+4^2$ $l=5$ cm Total surface area $=4\left(\frac{1}{2}\times 6\times 5\right)+(6\times 6)$ $=60+36$ $=96\text{ cm}^2$ Did not find the slant height (i.e. used 4 cm as the slant height) → no mark Wrong slant height obtained and used it to find the total surface area correctly → awarded only [M1].	M1 M1 A1
14	(a)	$x=11$	B1

Qn		Answer/Working	Marks/Remarks
	(b)(i)	$5+3+11+12+y+5=40$ $y=40-36$ $=4$ Did not show clearly how the value of y is obtained (e.g. mental calculation involved: **15** – 11 = 4) → no mark **Ecf** mark given if correct working shown for finding value of y using the wrong x value obtained from 14(a).	M1 A1
	(b)(ii)	$\text{mean}=\frac{15(5)+16(3)+17(11)+18(12)+19(4)+20(5)}{40}$ $=\frac{702}{40}$ $=\$17.55$ [A1] mark not awarded if final answer is written as fraction (e.g. $17\frac{11}{20}$) or has been rounded off ($17.60). When total number of students used for finding mean is **more than 40** (Note: total number of students is given in the question), **only [M1]** awarded if correct method and working shown. Omission of essential working in showing how mean money is calculated (e.g. student wrote $\frac{702}{40}$ without showing how 702 is found) → no mark	M1 A1

1(a)	$\frac{3}{x-2}-\frac{1}{x-3}=\frac{3(x-3)-(x-2)}{(x-2)(x-3)}$ $=\frac{3x-9-x+2}{(x-2)(x-3)}$ $=\frac{2x-7}{(x-2)(x-3)}$	M1 A1
Remarks: 1) Common mistake: not taking into account " – " when expanding, resulting in wrong answer of $\frac{2x-11}{(x-2)(x-3)}$ 2) Take note not to expand the denominator of the fraction when simplifying the expression		
(b)	$2x-3y=12 \quad -(1)$ $4x+y=3 \quad -(2)$ $(2)\times 3,\ 3(4x+y)=3(3)$ $12x+3y=9 \quad -(3)$ $(1)+(3),\ (2x-3y)+(12x+3y)=12+9$ $14x=21$ $x=1.5$ Substitute $x=1.5$ into (2), $4(1.5)+y=3$ $6+y=3$ $y=-3$ Therefore, the solution is $x=1.5$ and $y=-3$.	 M1 A1 A1
Remarks: 1) Students should show all the steps clearly. In the case of elimination method, students should show **how** they derive the simplified expression $14x=21$ or $-7y=21$. In the case of substitution method, students should show the substitution into the equation clearly. 2) Many did not check their solutions by substituting back to original equations. One simple check will show that their solutions are incorrect.		
(c)	$p=\sqrt{\frac{r-2}{3-4r}}$ $p^2=\frac{r-2}{3-4r}$ $p^2(3-4r)=r-2$ $3p^2-4p^2r=r-2$ $r+4p^2r=3p^2+2$ $r(1+4p^2)=3p^2+2$	 M1 M1

	$r = \frac{3p^2+2}{1+4p^2}$	A1
Remarks: 1) Careless mistake in shifting terms and changing the signs of each term 2) Did not fully make r the subject, leaving some terms with r on the right hand side of the solution		
2(a)	Shop A $= \frac{192}{y}$	B1
(b)	Shop B $= \frac{192}{y-2}$	B1
Remarks: 1) The expressions **should not** have any units accompanying it. Many leave the expressions in terms of $\$\frac{192}{y}$ and $\$\frac{192}{y-2}$. Students should note that the expression is for **number of mugs**, not the price. 2) Some left the expression as $192 \div y$ etc. Always simplify algebraic expressions.		
(ci)	$\frac{192}{y-2} - \frac{192}{y} = 8$ $192y - 192(y-2) = 8y(y-2)$ $192y - 192y + 384 = 8y^2 - 16y$ $8y^2 - 16y - 384 = 0$ $y^2 - 2y - 48 = 0$ Shown	M1 M1 A1
Remarks: 1) Very poorly done, with many unable to write the first equation accurately. 2) When simplifying the equation, the common mistake was again the incorrect expansion leading to students unable to simplify to the required equation.		
ii)	$(y-8)(y+6)=0$ $y=8, y=-6$	M1 A1
Remarks: 1) It is important to write $= 0$ as the first step before being able to solve the equation 2) Incorrect factorisation is a common mistake 3) There is no need to reject $y=-6$ in this part because the question only asks to solve the equation, not in the context of the question of cost of mug		
(d)	We have to reject $y=-6$, because y is the cost of a mug and the cost cannot be negative	B1
Remarks: 1) Answers that says y represents the **number of mugs** are rejected as the question clearly states that y represents the cost of a mug.		
3(a)	Map scale = 5 cm : 0.25 km = 1 cm : 0.05 km = 1 cm : 50 m = 1 cm : 5000 cm = 1 : 5000	A1
Remarks: 1) There should not have any units for map scale		

2) Many students who did not receive the full credit due to incorrect conversion of units		
(b)	Distance between Ahmad's Road and Prince's Road on map = 2.65 cm 2.65 cm : 13250 cm Walking distance between Ahmad's Road and Prince's Road is 132.5 m.	A1
Remarks: 1) Generally well done, students are awarded full credit for using (a) answer to compute the actual distance 2) Several students did not read the question and gave the answer in **km** instead		
(c)	Area of Hope Square on map = 1.95×1.95 $= 3.8025$ cm^2 Range acceptable: 3.42225 – 4.18275 cm^2 Area scale = 1 cm^2 : 2500 m^2 3.8025 cm^2 : 9506.25 m^2 Range acceptable: 8555.625 – 10456.875 m^2	M1 A1
Remarks: 1) Generally, presentation of working is slipshod and not clear 2) Again, mistakes arise due to wrong conversion of units, especially for area scale		

4(a)	$p = -1$	B1
(b)	 **S** – correct axes + scale + label of graph **P** – all points marked correctly **C** - smooth curve	B1 B1 B1
	Remarks: as a cohort, need more practice on graph drawing. This is foundation skill for sec 3 graph. Basic habit of label of graph & axes is fine. However, the ability to draw a smooth curve is lacking.	
(c)	$x = 2$ Remarks: the question as for an **equation (NEED TO HAVE AN '=' SIGN!!).** This question is badly done by most classes.	B1
(di)	y = -9 (+/-0.1)	B1
(dii)	**y = 1**	B1
(ei)	When $y = x - 2$ x: -3, 0, 4 y: -5, -2, 3 At least 2 points	B1

	smooth line + label Remarks: not well done. Many did not draw the line. For those who drew the line correctly, quite a number did not label the graph.	B1
(eii)	Coordinates points of intersection (-0.7 , -2.7) and (2.7 , 0.7) note: allow x = -0.7 +/- 0.1 or 2.7 +/- 0.1 Remarks: of those of managed to draw the straight line graph, i. quite a number could not read the coordinates correctly. ii. the questions asked for the **coordinates** of intersection. Coordinates needs to be presented in brackets form (-0.7 , -2.7) iii. some did not realise that there are 2 points of intersections. Generally, this Question is critical foundation for Sec 3 graph questions. Please do more practice!	B2
5(a)	$\cos \angle ABC = \frac{10}{26}$ $\angle ABC = \cos^{-1}\frac{10}{26} = 67.4°$ **Remarks**: quites a few students chose the wrong trigo ratio	M1 A1
(b)	$AC = \sqrt{26^2 - 10^2}$ (pythagoras' theorem) $= 24 cm$ The pythagoras' theorem needs to be stated when applying this formula. Many did not other to write it down.	M1 A1
(c)	Area of triangle ABD = $\frac{1}{2}(10)(24) = 120 cm^2$ Let the shortest distance be x. $\frac{1}{2}(x)(26) = 120$ $x = 9.23m(3sf)$ Or Let the shortest distance be x. $sin67.4 = \frac{x}{10}$ $x = 10sin67.4$ $= 9.23\ m\ (3sf)$	M1 A1
	Remarks: this question proofs to be challenging. The ability to see different was to find area of triangle is essential. Please do more practice of such question type.	

6(a)	Radius of the cone $= \frac{10}{2}$ $= 5$ cm Volume of the cone $= \frac{1}{3} \times \pi \times 5^2 \times 12$ $= 100\pi$ cm^3 Volume of each rubber stopper $= \frac{1}{2} \times 100\pi$ $= 50\pi$ $= 157.0796$ $= 157$ cm^3 (correct to 3 sig. fig.) Hence, the volume of each rubber stopper is 157 cm^3	M1 given when applied formula for volume of cone	M1 A1
Remarks: 1) The formula for cone is given, hence there **should not** be any problem with finding the volume of cone. However, some students failed to see that the height of cone is 12, not 13. Some even tried using Pythagoras' theorem to find the height of cone. 2) Many failed to see that the rubber stopper is **half** of a cone. 3) Answers for this question **must be given to 3 sf** to be awarded full credit			
6(b)	Area of semicircle $= \frac{1}{2} \times \pi \times 5^2$ $= \frac{25\pi}{2}$ cm^2 Area of flat surface of rubber stopper $= \frac{1}{2} \times 10 \times 12$ $= 60$ cm^2 Curved surface area of rubber stopper $= \frac{1}{2} \times \pi \times 5 \times 13$ $= \frac{65}{2}\pi$ cm^3 Total Surface area of each rubber stopper $= \frac{25\pi}{2} + 60 + \frac{65\pi}{2}$ $= 201.37167$ $= 201$ cm^2 (correct to 3 sig. fig.)	M2: Any 2 of the 3 areas found accurately will award M2 marks M1: Any 1 of the 3 areas	A1

Remarks: 1) Many failed to divide the curved surface area by 2 2) Many did not find the flat surface of the stopper 3) Radius of semicircle was not correctly identified 4) Did not round off to 3 sf		

7(a)	Base area = $\pi r^2 = \pi(5.5)^2$ $= 30.25\pi$ $= 95.0332$ $= 95.0\ cm^2$ (3sf) Remarks: some forgot to round off to 3sf. Some wrote 3 sf, but answer is not 3 sf	M1 A1
(b)	Vol = $\frac{1}{2}\left[\frac{4}{3}\pi(5.5)^3\right] + \pi(5.5)^2(31 - 5.5)$ $= 348.455 + 2423.346$ $= 2771.80$ $= 2770\ cm^3$ (3sf) **Remarks:** many fails to see that the height if the cylinder is not 31cm, that they have to deduct off the 5.5cm height of the hemisphere.	M2 A1
7(c)	Given density = 12.5 g/cm^3 Vol of 1 cm^3 → mass of 12.5 g Vol of 2771.8 cm^3 → mass of 12.5 x 2771.8 = 34647.5 g Mass of 40% of total volume = 34647.5 x 40% = 13859 g = 13.859 kg 1 kg = 9.8 Newton 13.859 kg = 13.859 x 9.8 = 135.8182 Newton Weight of content per square meter = $\frac{135.8182}{95.033}$ N / cm^2 = 1.4292 N / cm^2 Since the weight per square meter is less than 0.2 N/cm^2, the extinguisher will not explode. **Remarks:** 1m awarded only when student attempted at lease the first 2 multiplications correctly 2nd mark awards of students attempted the first 3 multiplications correctly Full marks is only awarded if conclusion is made correctly	* * M1 M1 * * A1