# BEATTY SECONDARY SCHOOL
# END-OF-YEAREXAMINATION 2014

**SUBJECT : Mathematics** **LEVEL : Sec 2 Express**

**PAPER : 1** **DURATION : 1 hour 15 minutes**

**SETTER : Mr Cheong Boon Wee** **DATE : 3 October 2014**

| CLASS : | NAME : | REG NO : |
|---|---|---|

## READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces on the top of this page.
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** 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.
You are expected to use a scientific calculator to evaluate explicit numerical expressions.
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 $\pi$, use either your calculator value or 3.142, unless the question requires the answer in terms of $\pi$.

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 Examiner's Use |
|---|
| 50 |

This paper consists of **11** printed pages (including this cover page)

[Turn over

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Answer **all** the questions.

*For Examiner's Use*

**1** **(a)** Simplify $4a^2-(2a+5)(2a-5)+a$.

*Answer : (a)* _____ [2]

**(b)** Express $\frac{1}{4m^2-16m-20}+\frac{m}{m-5}$ as a fraction in its simplest form.

*Answer : (b)* _____ [3]

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**2** Expand and simplify

**(a)** $(2m+3)(m-2)-(m+4)(m-3)$.

*Answer : (a)* _____ [3]

**(b)** Hence, solve the equation $(2m+3)(m-2)-(m+4)(m-3)=21$

*Answer : (b)* $m=$ _____ [3]



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3 Solve the simultaneous equations.

$$\frac{3x+y}{11}=\frac{1}{2}$$

$$x+y=3$$

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*Answer* : $x=$ _____

$y=$ _____ [3]

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4 **(a)** Factorise $4b^2 - 4c^2$.

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*Answer*: *(a)* _____ [2]

**(b)** Given that $4b^2 - 4c^2 = 224$, $b + c = 7$ and $bc = -\frac{15}{4}$,

**(i)** find the value of $b - c$,

*Answer*: *(b)(i)* _____ [1]

**(ii)** find the value of $b^2 + c^2$.

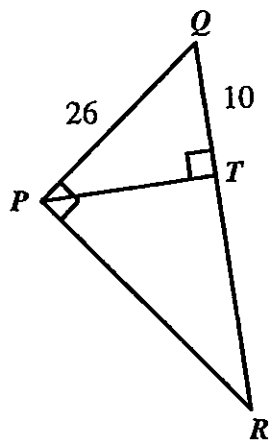
*Answer*: *(b)(ii)* _____ [2]

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5 In the diagram, triangle $PQR$ is similar to triangle $TQP$.

$PQ = 26$ cm, $QT = 10$ cm, $\angle QPR = 90^0$ and $\angle PTQ = 90^0$.




**(a)** Calculate $PT$.

*Answer*: *(a)* $PT =$ _____ cm [2]

**(b)** Calculate $\angle QPT$.

*Answer*: *(b)* $\angle QPT =$ _____ ° [2]

**(c)** Calculate $PR$.

*Answer*: *(c)* $PR =$ _____ cm [2]

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6 The time needed to complete a project is inversely proportional to the number of students involved.
5 students can complete the project in 9 hours.

*For Examiner's Use*

**(a)** Calculate the number of students needed to complete the project in 3 hours.

*Answer*: *(a)* _____ [2]

**(b)** Calculate the time taken for 8 students to complete the project.
Leave your answer to the nearest minute.

*Answer*: *(b)* _____ minutes [2]



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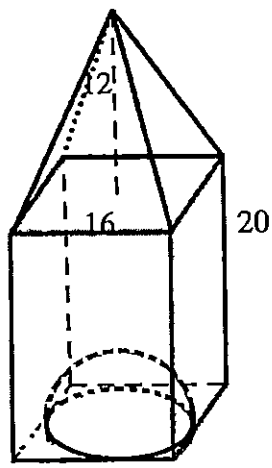
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7 A solid pyramid has a square base of side 16 cm and height 12 cm.
A cuboid has a square base of side 16 cm and height 20 cm.

A metal toy is made by attaching the bases of the pyramid and the cuboid. A hemisphere of diameter 16 cm is then carved out from the bottom of the cuboid.

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

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




**(a)** Calculate the volume of the toy.

*Answer* : *(a)*Volume = _____ $cm^3$ [3]

**(b)** Calculate the surface area of the toy.

*Answer* : *(b)*Surface Area = _____ $cm^2$ [4]

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*For Examiner's Use*

**8** In a bag, there are 32 red balls and some yellow balls.
The probability that one yellow ball is chosen at randomis $\frac{5}{13}$.

**(a)** Find the probability that one red ball is chosen at random.

*Answer:* *(a)* _____ [1]

**(b)** Find the total number of red and yellow balls in the bag.

*Answer:* *(b)* _____ [1]

**(c)** $(x-3)$ yellow balls are removed from the bag.

The new probability that one yellow ball is chosenat random is $\frac{1}{3}$.

Find the value of $x$.

*Answer:* *(c)* $x =$ _____ [2]

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**9** A survey was carried out to find the number of minutes spent on computer games in a day by a group of students.
The result of this survey is shown in the frequency table below.

| Number of minutes ( $n$ minutes ) | Frequency ( $f$ ) |
|---|---|
| $0 \leq n < 20$ | 15 |
| $20 \leq n < 40$ | 8 |
| $40 \leq n < 60$ | 34 |
| $60 \leq n < 80$ | 23 |

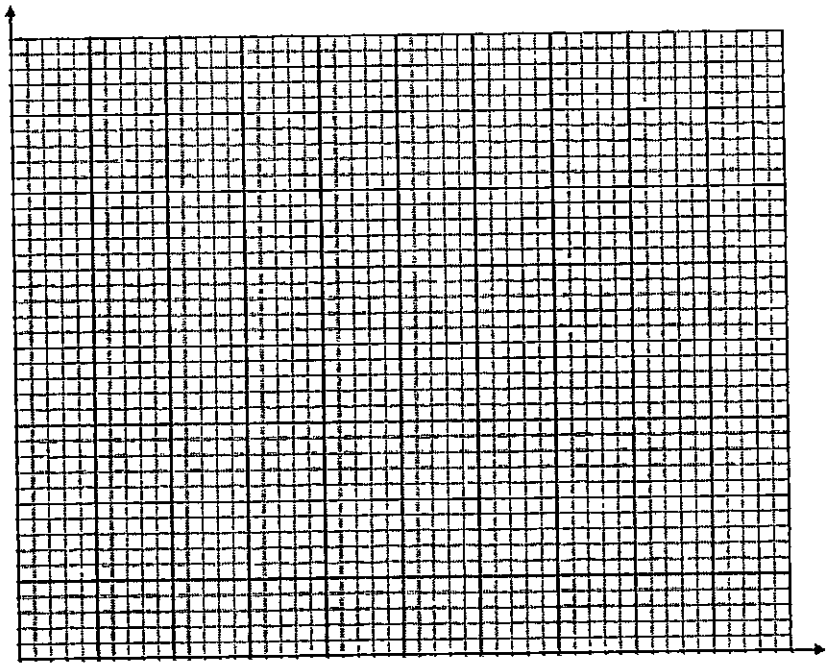
**(a)** Calculate the total number of students surveyed.

*Answer* : *(a)* _____ [1]

**(b)** Find the mean time spent on playing computer games.

*Answer* : *(b)* _____ minutes [2]

**(c)** Draw a histogram on the grids below to illustrate the information.
You are required to label the axes clearly.



[3]

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*For Examiner's Use*

**10** Ten boys and ten girls recorded their total walking distance in one week.
The results are shown in the stem-and-leaf diagram.

| Boys | | | | Girls | | |
|---|---|---|---|---|---|---|
| | 4 | 3 | 2 | 1 | 7 | 8 |
| | | 2 | 3 | 2 | 4 | 5 5 |
| | 5 | 5 | 4 | | | |
| 8 | 8 | 2 | 5 | 4 | 5 | 8 |
| | 6 | 4 | 6 | | | |

Key (Boys)
3 | 2 means 23 km

Key (Girls)
2 | 1 means 21 km

**(a)** Write down the median distance of the boys.

*Answer*: *(a)* _____ km [1]

**(b)** Write down the mode of the boys and girls.

*Answer*: *(b)* _____ km [1]

**(c)** If one more girl is included into the data, the mean distance of the girls will be 38. Calculate the distance travelled by this girl.

*Answer*: *(c)* _____ km [2]

**~End of Paper~**

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## Answers

**1(a)** $a+25$

**1(b)** $\dfrac{(1+2m)^2}{8m^2-36m-20}$

**2(a)** $m^2-2m+6$

**2(b)** $m=5$ or $m=-3$

**3** $x=\dfrac{5}{4}, y=\dfrac{7}{4}$

**4(a)** $4(b+c)(b-c)$

**4(b)**
**(i)** 224

**(ii)** $\dfrac{113}{2}$

**5(a)** 24

**5(b)** 22.6°

**5(c)** 62.4 cm

**6(a)** 338

**6(b)** 15

**7(a)** 5070

**7(b)** 2200

**8(a)** $\dfrac{8}{13}$

**8(b)** 52

**8(c)** 7

**9(a)** $46\dfrac{1}{4}$

**9(b)** $46\dfrac{1}{4}$

**10(a)** 48.5

**10(b)** 58

**10(c)** 39

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Answer **all** the questions.

**1** **(a)** Simplify $4a^2-(2a+5)(2a-5)+a$.

$=4a^2-(4a^2-25)+a$ [M1]
$=a+25$ [A1]

*Answer*: *(a)* $a+25$ [2]

**(b)** Express $\dfrac{1}{4m^2-16m-20}+\dfrac{m}{m-5}$ as a fraction in its simplest form.

$=\dfrac{1}{4(m^2-4m-5)}+\dfrac{m}{m-5}$

$=\dfrac{1}{4(m-5)(m+1)}+\dfrac{m}{m-5}$ [M1]

$=\dfrac{4m(m+1)+1}{4(m-5)(m+1)}$ [M1]

$=\dfrac{4m^2+4m+1}{4(m-5)(m+1)}$ [A1]

or

$\dfrac{(1+2m)^2}{4(m-5)(m+1)}$

*Answer*: *(b)* $\dfrac{(1+2m)^2}{4(m-5)(m+1)}$ [3]

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**2** Expand and simplify

**(a)** $(2m+3)(m-2)-(m+4)(m-3)$.

$= (2m^2 - 4m + 3m - 6) - (m^2 + m - 12)$ [M1 – *expansion*]

$= 2m^2 - 4m + 3m - 6 - m^2 - m + 12$ [M1 – *correct removal of brackets*]

$= m^2 - 2m + 6$ [A1]

*Answer : (a)* $m^2 - 2m + 6$ [3]

**(b)** Hence, solve the equation $(2m+3)(m-2)-(m+4)(m-3) = 21$

$m^2 - 2m + 6 = 21$

$m^2 - 2m - 15 = 0$ [M1]

$(m-5)(m+3)=0$ [M1 – *correct factorisation*]

$m = 5$ or $m = -3$ [A1]

*Answer : (b)* $m=$ $m = 5$ or $m = -3$ [3]

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3 Solve the simultaneous equations.

$\frac{3x+y}{11}=\frac{1}{2}$ ----------(1)

$x+y=3$ ----------(2)

From (2): $x=3-y$ ----------(3)

Sub (3) into (1): $\frac{3(3-y)+y}{11}=\frac{1}{2}$

$\frac{9-3y+y}{11}=\frac{1}{2}$ [M1 – *substitution / elimination method*]

$\frac{9-2y}{11}=\frac{1}{2}$

$9-2y=\frac{11}{2}$

$y=\frac{7}{4}$ [A1]

Sub $y=\frac{7}{4}$ into (3): $x=3-\frac{7}{4}=\frac{5}{4}$ [A1]

*Answer*: $x=$ $\frac{5}{4}$

$y=$ $\frac{7}{4}$ [3]

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**4** **(a)** Factorise $4b^2 - 4c^2$.

$= 4(b^2 - c^2)$ [M1]
$= 4(b+c)(b-c)$ [A1]

*Answer*: *(a)* $4b^2 - 4c^2 =$ $4(b+c)(b-c)$ [2]

**(b)** Given that $4b^2 - 4c^2 = 224$, $b+c=7$ and $bc = -\frac{15}{4}$,

**(i)** find the value of $b-c$,

$4(7)(b-c) = 224$
$b-c = 8$ [B1]

*Answer*: *(b)(i)* $b-c =$ $8$ [1]

**(ii)** find the value of $b^2+c^2$.

$(b+c)^2 = b^2 + 2bc + c^2$
$7^2 = b^2 + c^2 - 2(-\frac{15}{4})$ [M1]
$b^2 + c^2 = 49 + \frac{15}{2}$
$= \frac{113}{2}$ [A1]

*or*

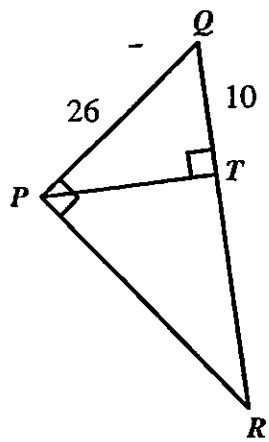
$(b-c)^2 = b^2 - 2bc + c^2$
$8^2 = b^2 + c^2 - 2(-\frac{15}{4})$ [M1]
$b^2 + c^2 = 64 - \frac{15}{2}$
$= \frac{113}{2}$ [A1]

*Answer*: *(b)(ii)* $b^2+c^2 =$ $\frac{113}{2}$ [2]

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**5** In the diagram, triangle $PQR$ is similar to triangle $TQP$.

$PQ = 26$ cm, $QT = 10$ cm, $\angle QPR = 90^0$ and $\angle PTQ = 90^0$.




**(a)** Calculate $PT$.

*By Pythagoras' Theorem*

$PT = \sqrt{26^2 - 10^2}$ [M1]

$= 24$ [A1]

*Answer*: *(a)* $PT =$ 24 cm [2]

**(b)** Calculate $\angle QPT$.

$\sin \angle QPT = \frac{10}{26}$ [M1 – *can use other basic trigo ratios*]

$\angle QPT = \sin^{-1}\left(\frac{10}{26}\right)$

$= 22.6°$ (1 d.p.) [A1]

*Answer*: *(b)* $\angle QPT =$ 22.6 ° [2]

**(c)** Calculate $PR$.

$\frac{PR}{24} = \frac{26}{10}$ [M1√ – *or* alternative methods]

$PR = \frac{26}{10} \times 24$

$= 62.4$ cm [A1]

*Answer*: *(c)* $PR =$ 62.4 cm [2]

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6 The time needed to complete a project is inversely proportional to the number of students involved.
5 students can complete the project in 9 hours.

**(a)** Calculate the number of students needed to complete the project in hours.

Let t be the time taken in hours, and s be the number of students.

$t = \frac{k}{s}$, where k is a constant.

$9 = \frac{k}{5}$ [M1]

$k = 45$

$t = \frac{45}{s}$

When $t = 3$

$3 = \frac{45}{s}$ [M1]

s = 15 [A1]

*Answer*: *(a)* 15 [3]

**(b)** Calculate the time taken for 8 students to complete the project.
Leave your answer to the nearest minute

When $s = 8$,

$t = \frac{45}{8}$ [M1]

$t = 5.625$ hours

$t = 5.625 \times 60$

= 338 minutes (3 s.f.) [A1]

*Answer*: *(b)* 338 minutes [2]

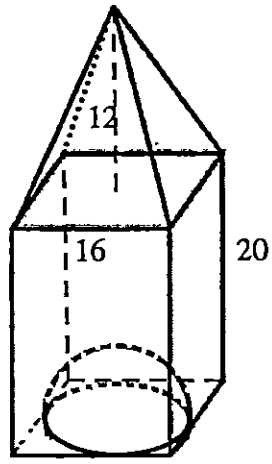
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7 A solid pyramid has a square base of side 16 cm and height 12 cm.
A cuboid has a square base of side 16 cm.

A metal toy is made by attaching the bases of the pyramid and the cuboid. A hemisphere of diameter 16 cm is then carved out of the cuboid.

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

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




(a)Calculate the volume of the toy.

Volume of pyramid $= \frac{1}{3}\times 16^2 \times 12$

$= 1024 \text{ cm}^3$ [M1]

Volume of cuboid $= 16^2 \times 20$

$= 5120 \text{ cm}^3$

Volume of hemisphere $= \frac{1}{2}\left(\frac{4}{3}\pi \times 8^3\right)$ [M1]

$= 341\frac{1}{3}\pi \text{ cm}^3$

Volume of toy $= 1024 + 5120 - 341\frac{1}{3}\pi$

$= 5070 \text{ cm}^3$ (3 s.f.) [A1]

*Answer* : *(a)*Volume = 5070 $\text{cm}^3$ [3]

**(b)** Calculate the surface area of the toy.

Surface area of slant faces $= 4\times\left(16\times\sqrt{12^2+8^2}\times\frac{1}{2}\right)$ [M1]

$= 461.510 \text{ cm}^2$

Surface area of rectangular faces and base of cuboid (carved)

$= \left[4\times(16\times 20)\right] + \left(16^2 - 8^2\times\pi\right) + \frac{1}{2}\left[4\pi\times 8^2\right]$ [M1]

$= 1737.0619 \text{ cm}^2$ [M1– interior curved surface of hemisphere]

Total surface area

$= 461.510 + 1737.0619$

$= 2198.57$

$= 2200 \text{ cm}^2$ (3 s.f.) [A1]

*Answer* : *(b)*Surface Area = 2200 $\text{cm}^2$ [4]

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**8** In a bag, there are 32 red balls and some yellow balls.
The probability that one yellow ball is chosen is $\frac{5}{13}$.

**(a)** Find the probability that one red ball is chosen at random.

$$\text{P(red ball)} = 1 - \frac{5}{13}$$
$$= \frac{8}{13} \qquad \text{[B1]}$$

*Answer:* *(a)* $\frac{8}{13}$ [1]

**(b)** Find the total number of red and yellow balls in the bag.

Number of yellow balls
$$= 32 \times \left( \frac{5}{13} \div \frac{8}{13} \right)$$
$$= 32 \times \frac{5}{8}$$
$$= 20$$
Total red & yellow balls
$$= 32 + 20$$
$$= 52 \qquad \text{[B1]}$$

or

8 units = 32 balls
13 units $= 13 \times \frac{32}{8}$
$= 52$ balls [B1]

*Answer:* *(b)* 52 [1]

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**(c)** $(x-3)$ yellow balls are removed from the bag.
The new probability that one yellow ball is chosen is $\frac{1}{3}$.
Find the value of $x$.

$n(S) = 52-(x-3)$
$= 55-x$
$n(\textit{yellow balls}) = 20-(x-3)$
$= 23-x$
$\frac{23-x}{55-x} = \frac{1}{3}$ [M1]
$69-3x = 55-x$
$2x = 14$
$x = 7$ [A1]

or

$P(\textit{red balls}) = \frac{2}{3}$
2 units = 32 balls
1 units = 16 balls
Number of yellow balls removed
$= 20-16$ [M1]
$= 4$
$x-3 = 4$
$x = 7$ [A1]

*Answer :* *(c)* $x =$ 7 [2]

**9** A survey was carried out to find the number of minutes spent on computer games in a day by a group of students.
The result of this survey is shown in the frequency table below.

| Number of minutes ( $n$ minutes ) | Frequency ( $f$ ) |
|---|---|
| $0 \le n < 20$ | 15 |
| $20 \le n < 40$ | 8 |
| $40 \le n < 60$ | 34 |
| $60 \le n < 80$ | 23 |

**(a)** Calculate the total number of students surveyed.

$= 15+8+34+23$
$= 80$ [B1]

*Answer :* *(a)* 80 [1]

**(b)** Find the mean time spent on playing computer games.

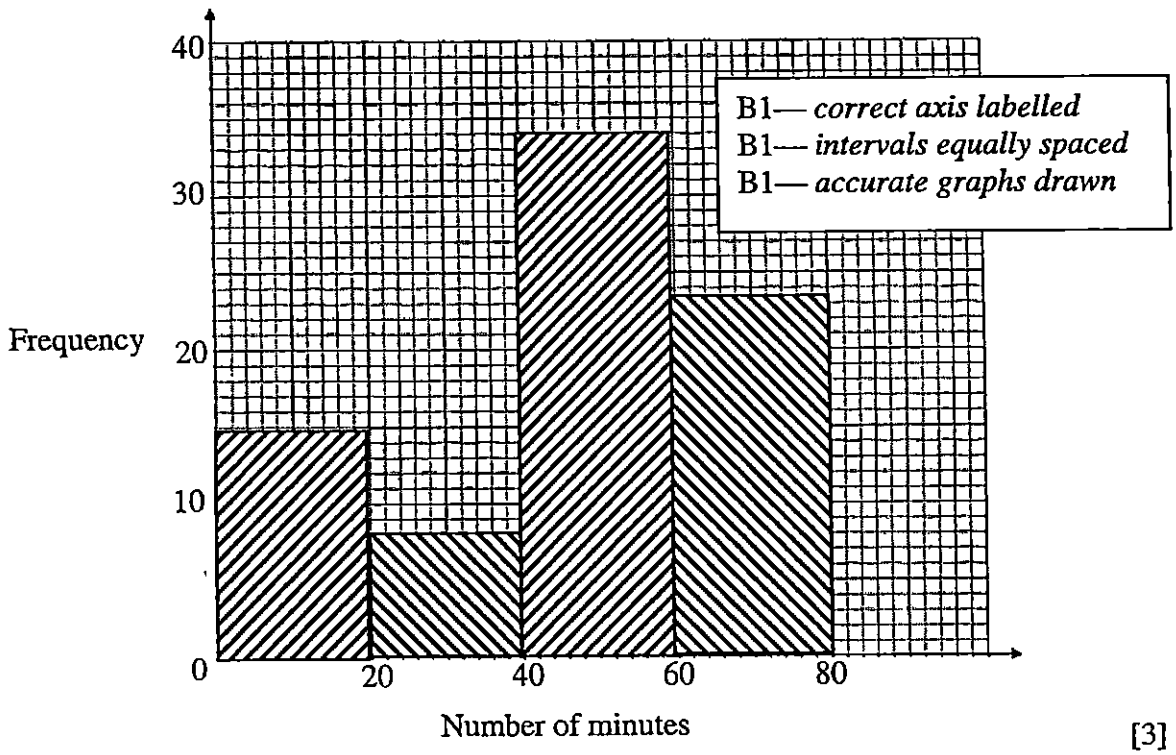
| Mid-value (n) | (f) |
|---|---|
| 10 | 15 |
| 30 | 8 |
| 50 | 34 |
| 70 | 23 |

$\text{Mean} = \frac{10(15)+30(8)+50(34)+70(23)}{80}$ [M1]
$= 46.25$ or $46\frac{1}{4}$ minutes [A1]

*Answer :* *(b)* $46\frac{1}{4}$ minutes [2]

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**(c)** Draw a histogram on the grids below to illustrate the information.




[3]

**10** Ten boys and ten girls recorded their total walking distance in one week.

The results are shown in the stem-and-leaf diagram.

| Boys | | | | Girls | | | |
|---|---|---|---|---|---|---|---|
| | 4 | 3 | 2 | 1 | 7 | 8 | |
| | | 2 | 3 | 2 | 4 | 5 | 5 |
| | 5 | 5 | 4 | | | | |
| 8 | 8 | 2 | 5 | 4 | 5 | 8 | |
| | 6 | 4 | 6 | | | | |

Key (Boys)
3 | 2 means 23 km

Key (Girls)
2 | 1 means 21 km

**(a)** Write down the median distance of the boys.

23,24,32,45,45,52,58,58,64,66

$\frac{45+52}{2} = 48.5$ [B1]

*Answer*: *(a)* 48.5 km [1]

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**(b)** Write down the mode of the boys and girls.

58 [B1]

*Answer : (b)* 58 km [1]

**(c)** If one more girl is included into the data, the mean distance of the girls will be 38. Calculate the distance travelled by this girl.

Let $x$ be the distance travelled by the girl.

Using mean,

$$\frac{21+27+28+32+34+35+35+54+55+58+x}{11}=38 \quad \text{[M1]}$$

$$\frac{379+x}{11}=38$$

$$x=418-379$$

$$x=39 \quad \text{[A1]}$$

*Answer : (c)* 39 km [2]

~End of Paper~

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# BEATTY SECONDARY SCHOOL
# END-OF-YEAR EXAMINATION 2014

**SUBJECT : Mathematics** | **LEVEL : Sec 2 Express**

**PAPER : 2** | **DURATION : 1 hour 30 minutes**

**SETTER : Mdm See Huey Yi** | **DATE : 09 Oct 2014**

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## READ THESE INSTRUCTIONS FIRST

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Calculators should be used 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 $\pi$, use either your calculator value or 3.142, unless the question requires the answer in terms of $\pi$.

At the end of the examination, fasten all your work securely together.
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**.



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1 **(a)** The scale of map $X$ is 1 cm : 0.2 km and the scale of map $Y$ is 1 : 50 000.
Given that the area of a park on map $X$ is 5.5 $cm^2$, find the area, in $cm^2$, of the same park on map $Y$. [3]

**(b)** $p$ is directly proportional to the square of $q$. It is known that $p = 14$ for a particular value of $q$. When $q$ is increased to 200%, find the percentage increase in $p$. [3]

2 **(a)** Expand $2(3x-5)(-x+4)$. [2]

**(b)** Express $\frac{x-2}{4x^2-9} \div \frac{3x^2-4x-4}{2x-3}$ in its simplest form. [3]

**(c)** Given that $\frac{2a}{5} = \frac{b}{4} + \frac{3}{bc^2}$, make $c$ the subject of the formula. [3]

3 $(5, -1)$ and $(-2, 6)$ are 2 points on a linear function $py = qx - 2$.

**(a)** Form a pair of simultaneous equations to represent the above information and show that the equations can be simplified to

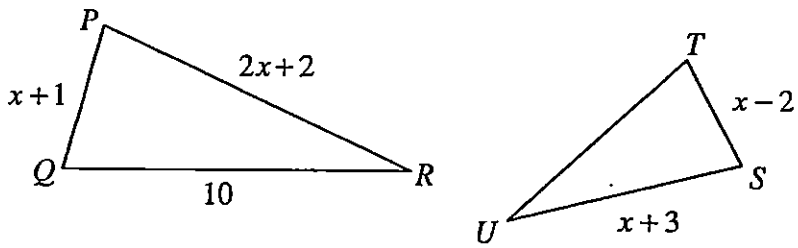
$$p + 5q = 2$$
$$3p + q = -1$$ [2]

**(b)** Solve the simultaneous equations in part **(a)**. [3]

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4 In the figure below, $\Delta PQR$ is similar to $\Delta STU$.

It is given that $PQ = (x+1)$ cm, $PR = (2x+2)$ cm, $QR = 10$ cm, $US = (x+3)$ cm and $TS = (x-2)$ cm.




(a) Form an equation in terms of $x$ and show that it reduces to $x^2 - 6x - 7 = 0$. [2]

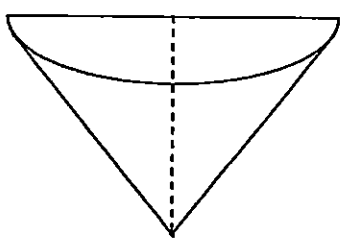
(b) Solve $x^2 - 6x - 7 = 0$. [2]

(c) **Hence**, find the perimeter of $\Delta PQR$. [1]

5 The figure shows a semicircular solid cone. The radius of the base is half its slant height. The curved surface area of the semicircular cone is 36.8 cm².

[Curved surface area of cone $= \pi rl$]

$\left[\text{Volume of cone} = \frac{1}{3}\pi r^2 h\right]$



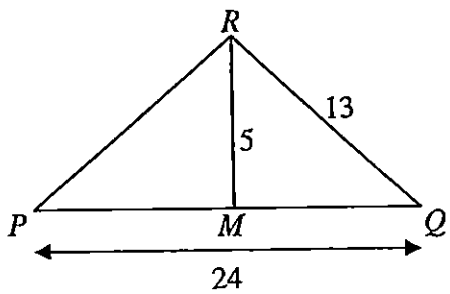
(a) Find the radius of the semicircular cone. [2]

(b) Hence, find the volume of the semicircular cone. [3]



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**6 (a)** The diagram shows a triangle $PQR$ where $QR$= 13 cm and $PQ$ = 24 cm. $M$ is the midpoint of $PQ$ and $RM$ = 5 cm.




**(i)** Show that $\Delta RMQ$ is a right-angled triangle. [2]

**(ii)** Calculate $\angle PRQ$. [2]

**(b)** A 3-digit number is formed at random using the digits 1, 3 and 6 without repetition of the digits.

**(i)** Write down the sample space. [1]

**(ii)** Find the probability that the 3-digit number formed is greater than 700. [1]

**(iii)** Find the probability that the 3-digit number formed is an even number. [1]

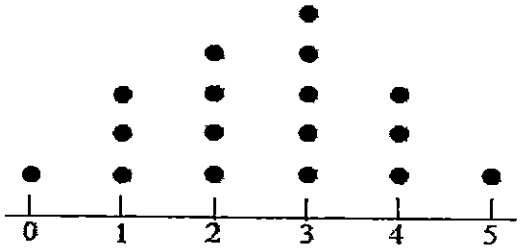
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7 **(a)** A survey was conducted to find the number of hours a group of students spend on surfing the internet on a particular day. The results are shown in the table below.

| Number of hours | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Number of students | 2 | 11 | $x$ | 5 | 8 | 4 |

If the median is 3, find the smallest possible value of $x$. [1]

**(b)** The dot diagram shows the number of story books read by a group of students in a particular week.



Number of story books

**(i)** Find the modal number of story books read. [1]

**(ii)** Find the mean number of story books read. [2]

**(iii)** If two students are removed from the group, the mean number of story books read is 2.4. Calculate the total number of story books these two students read. [2]


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

The table below gives some values of $x$ and the corresponding values of $y$, where $y = -2x^2 - x + 6$.

| $x$ | $-3$ | $-2$ | $-1$ | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| $y$ | $-9$ | $a$ | 5 | 6 | 3 | $-4$ | $-15$ |

**(a)** Find the value of $a$. [1]

**(b)** Using a scale of 2 cm to represent 1 unit on the $x$-axis and 1 cm to represent 1 unit on the $y$-axis, draw the graph of $y = -2x^2 - x + 6$ for $-3 \leq x \leq 3$. [3]

**(c)** **Use your graph** to

**(i)** find the coordinates of the turning point, [1]

**(ii)** find the equation of the line of symmetry, [1]

**(iii)** find the negative value of $x$ when $y = 4$, [1]

**(iv)** solve $2x^2 + x - 6 = 0$. [1]

***~ End of Paper ~***

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**Answer (BTY EOY 2E(P2) 2014**

1(a) $0.88\ \text{cm}^2$

(b) 300%

2(a) $-6x^2+34x-40$

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

(c) $c=\pm\sqrt{\dfrac{60}{b(8a-5b)}}$ or $c=\pm\sqrt{\dfrac{60}{8ab-5b^2}}$

3(a) $p(-1)=q(5)-2$

$p(6)=q(-2)-2$

(b) $p=-0.5$ and $q=0.5$

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

(b) $x=-1$ or $7$

(c) 34 cm

5(a) 3.42 cm

(b) $36.4\ \text{cm}^3$

6(aii) 134.8°

(bi) {136, 163, 316, 361, 613, 631}

(bii) 0

(biii) $\dfrac{1}{3}$

7(a) 5

(bi) 3

(bii) $2\dfrac{9}{17}$ or 2.53

(biii) 7

8(a) 0

(ci) $(-0.25\ ,\ 6.2)$ [Note : $-0.3\le x\le -0.2\ ,\ 6.1\le y\le 6.3$]

(cii) $x=-0.25$

(ciii) $x=-1.3\ \ (\pm 0.1)$

(civ) $x=-2$ or $x=1.5\ (\pm 0.1)$



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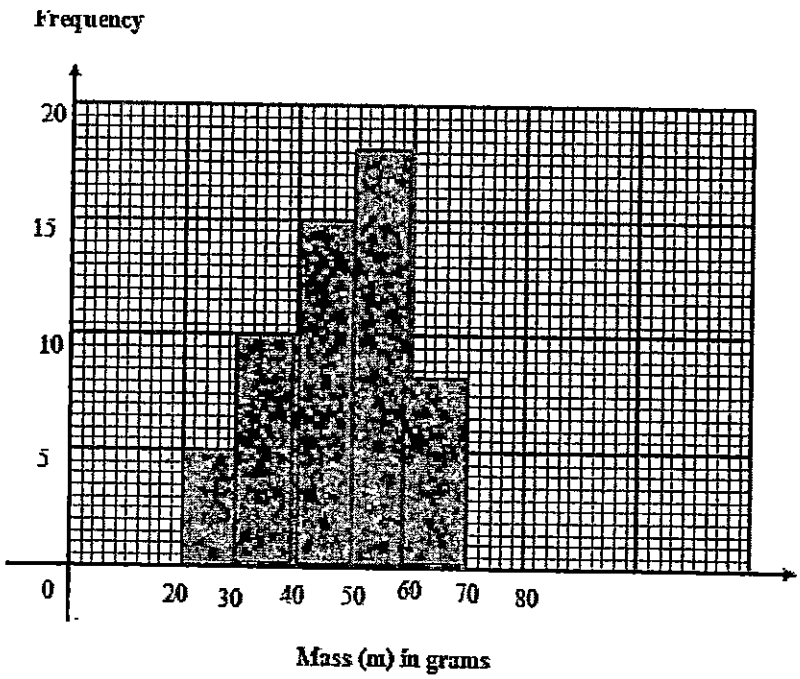

**End of Year Examination**
**Sec 2 Express 2014**
**Mathematics**
**Paper 2**
**Marking Scheme**

| No | Working | Allocation of Marks |
|---|---|---|
| 1 | Perimeter of triangle $= \frac{5}{2}\times(2+3+4)=22.5$ cm | B1 |
| 2 | $m = kn^3$<br>When $m = 52, n = n_1$, $52 = \frac{k}{(n_1)^3}$<br>When $n = \frac{n_1}{2}$, $m = k\left(\frac{n_1}{2}\right)^3$<br>$m = \frac{52}{(n_1)^3}\times\frac{(n_1)^3}{8}$<br>$m = \frac{13}{2}$<br>Or<br>m : $n^3$<br>= 52: $n^3$<br>= m: $\left(\frac{n}{2}\right)^3$<br>$= m : \frac{n^3}{8}$<br>Form equation and solve for m, m = 6.5 | M1<br><br>A1<br><br>M1 , A1 / B2 |
| 3 | $7(x+22)+3\times144=(10-2)\times180$<br>$7x + 154 + 432 = 1440$<br>$7x = 854$<br>$x = 122$<br><br>or $7(180-(x+22))+3(180-144)=360$<br>$1260 - 7x - 154 + 3(36) = 360$<br>$1214 - 360 = 7x$<br>$x = 122$ | M1 (form equation for sum of interior angle)<br><br>A1<br><br>M1 (form equation for sum of exterior angles)<br><br>A1 |
| 4(a) | $2y^2+11y-6=(2y-1)(y+6)$ | B1 |
| 4(b) | $\frac{2y^2+11y-6}{4y^2-1}$<br>$=\frac{(2y-1)(y+6)}{(2y-1)(2y+1)}$<br>$=\frac{y+6}{2y+1}$ | B1 factorize denominator<br><br>B1 (answer) |

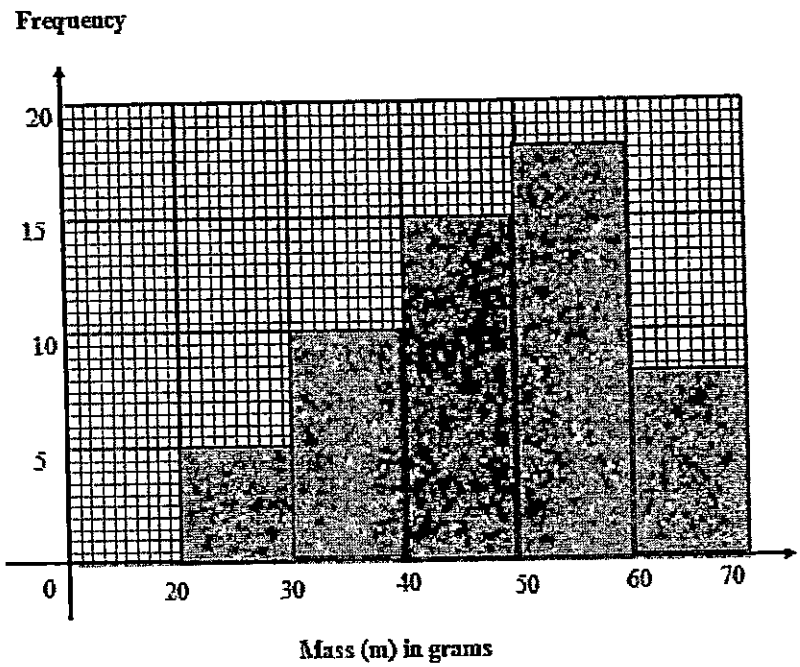
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| No | Working | Allocation of Marks |
|---|---|---|
| 5(a) | $0.9+0.25x \le 5$ or $90+25x \le 500$ | B1 |
| 5(b) | $0.9+0.25x \le 5$ or $90+25x \le 500$<br>$x \le \frac{5-0.90}{0.25}$ $x \le \frac{500-90}{25}$<br>$x \le 16.4$ $x \le 16.4$ | B1 |
| 5(c) | Maximum words = 16 | B1 / FT1 |
| 6 | $p=\sqrt{\frac{w}{2w-3x}}$<br>$p^2=\frac{w}{2w-3x}$<br>$p^2(2w-3x)=w$<br>$2p^2w-3p^2x=w$<br>$2p^2w-w=3p^2x$<br>$w(2p^2-1)=3p^2x$<br>$w=\frac{3p^2x}{2p^2-1}$ | M1 remove square root<br>M1 Factorize $w$<br>A1 |
| 7(a) | $9x+4=3x-(7-2x)$<br>$9x+4=3x-7+2x$<br>$9x-3x-2x=-7-4$<br>$4x=-11$<br>$x=-\frac{11}{4}$ or $-3.25$ | M1 remove bracket correctly (+ x)<br>A1 |
| 7(b) | $(z-6)^2=121$<br>$z-6=\pm\sqrt{121}$<br>$z-6=11$ or $z-6=-11$<br>$z=17$ or $z=-5$<br><br>Or<br>$(z-6)^2=121$<br>$z^2-12z+36=121$<br>$z^2-12z-85=0$<br>$(z-17)(z+5)=0$<br>$z=17$ or $z=-5$ | M1 (square root)<br>A1 (for both answers)<br><br>M1 (Factorization) / expand and simplify<br>A1 (both answers) |
| 8a | 1 : 600 000<br>1 cm represent 6 km<br>8 cm represent 48 km. | B1 |
| 8b | 1 cm represent 6 km<br>1 $cm^2$ represent 36 $km^2$<br>36 $km^2$ represent 1 $cm^2$<br>900 $km^2$ represent $\frac{1}{36}\times 900 = 25$ $cm^2$ | M1 (Area scale)<br>A1 |

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<table>
<tr><th>No</th><th>Working</th><th>Allocation of Marks</th></tr>
<tr><td>9</td><td>$2(x-y)^2 = 128$ and $xy = 20$<br>$(x-y)^2 = 64$<br>$x^2 - 2xy + y^2 = 64$<br>$x^2 + y^2 = 64 + 2(20)$<br>$x^2 + y^2 = 104$<br>$(x+y)^2 = 104 + 2(20)$<br>$(x+y)^2 = 144$<br>$5(x+y)^2 = 720$</td><td>M1 find $x^2 + y^2$ value<br>M1 for $(x+y)^2$<br>A1</td></tr>
<tr><td>10</td><td>Height of tree + Height of cliff = x<br>Height of Cliff = h<br>$\tan 58 = \frac{x}{85}$<br>$x = \tan 58° \times 85$<br>$\tan 43° = \frac{h}{85}$<br>$h = \tan 43° \times 85$<br>Height of tree = $\tan 58° \times 85 - \tan 43° \times 85$<br>= 56.8 m (3 s.f.)</td><td>M1 (Use tangent ratio to find either height of cliff or height of cliff and tree)<br>M1<br>A1</td></tr>
<tr><td>11(a)</td><td><table><tr><th>Masses (m) in grams</th><th>Mid-value</th><th>Frequency, $f$</th></tr><tr><td>$20 < m \leq 30$</td><td>25</td><td>5</td></tr><tr><td>$30 < m \leq 40$</td><td>35</td><td>10</td></tr><tr><td>$40 < m \leq 50$</td><td>45</td><td>15</td></tr><tr><td>$50 < m \leq 60$</td><td>55</td><td>18</td></tr><tr><td>$60 < m \leq 70$</td><td>65</td><td>7</td></tr></table></td><td>B1 for all values to be correct</td></tr>
<tr><td>11(b)</td><td>
</td><td>Labelling of axis correctly B1<br>Draw the bars correctly B1<br>Minus 1 for any error</td></tr>
</table>

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| No | Working | Allocation of Marks |
|---|---|---|
| 11b | Alternative drawing<br><br> | Labelling of axis correctly B1<br>Draw the bars correctly B1<br>Minus 1 for any error |
| 11c | Estimated mean<br>$= \frac{(25\times5)+(35\times10)+(45\times15)+(55\times18)+(65\times7)}{(5+10+15+18+7)}$<br>$= \frac{2595}{55}$<br>$=47.2$ (3 s.f.) or $47\frac{2}{11}$ | M1<br>A1 or B2 |
| 12(a)(i) | $x=k+1, y=k+5, z=k+6$ | B1 all three correct |
| 12(a)(ii) | $xy-kz$<br>$=(k+1)(k+5)-k(k+6)$<br>$=k^2+6k+5-k^2-6k$<br>$=5$ | M1Expansion or either bracket correctly<br>A1 answer |
| 12(a)(iii) | The difference between them is 5.<br>$kz=k^2+6k; xy=(k^2+6k)+5.$<br>Since the difference between them is 5, therefore, they must lie in the same column. | B1 |
| 12(b) | $k=5n-1$ or $4+5(n-1)$ | B1 |
| 13(a) | *Volume of cone* $= \frac{1}{3}\times6^2\times8\times\pi = 96\pi\ cm^3$<br>*Volume of cylinder* $= \pi\times9^2\times12=972\pi\ cm^3$<br>*Volume of solid* $= 972\pi-96\pi$<br>$=876\pi\ cm^3$ | M1 (vol. of cone)<br>M1(Vol. of cylinder – Vol. of cone)<br>A1 |
| | | |

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| No | Working | Allocation of Marks |
|---|---|---|
| 13(b)(i) | *By Pythagoras Theorem,*<br>*Slant height* $= \sqrt{6^2+8^2}$<br>$= 10$ *cm*<br>*Surface area of cone to be painted*<br>*= curved surface area of cone*<br>$= \pi \times 6 \times 10$<br>$= 60\pi$ $cm^2$ | B1<br><br>AG1 |
| 13(b)(ii) | *Area of ring to be painted* $= \pi \times (9^2 - 6^2) = 45\pi$ $cm^2$<br>*Curved surface of cylinder* $= 2 \times \pi \times 9 \times 12 = 216\pi$ $cm^2$<br>*Base of ornament* $= \pi \times 9^2 = 81\pi$ $cm^2$<br>*Total surface area to be painted* $= 60\pi + 45\pi + 216\pi + 81\pi$<br>$= 402\pi$ $cm^2 = 1260$ $cm^2$ *(3 s.f.)*or 1263.084 $cm^2$ | M1 (Area of ring)<br>M1 / FT1 (if slant height is wrong)<br><br>A1 (No FT1 if slant height is wrong) |
| 13(c) | *Volume of solid* $= 876\pi$ $cm^3$<br>*Volume of sphere* $= 876\pi$ $cm^3$<br>$\frac{4}{3}\pi r^3 = 876\pi$<br>$r = \sqrt[3]{\frac{876 \times 3}{4}}$<br>$r = 8.69337$<br>$r = 8.69$ *cm* | <br><br><br>Make *r* the subject with cube root , M1<br><br>A1 |
| 14(a) | $S\$\frac{2100}{x}$ | B1 |
| 14(b) | $S\$\frac{2100}{x+3}$ | B1 |
| 14(c)(i) | $\frac{2100}{x} - \frac{2100}{x+3} = 9$<br>$\frac{2100(x+3) - 2100x}{x(x+3)} = \frac{9(x)(x+3)}{x(x+3)}$<br>$2100x + 6300 - 2100x = 9x^2 + 27x$<br>$9x^2 + 27x - 6300 = 0$<br>$9(x^2 + 3x - 700) = 0$<br>$x^2 + 3x - 700 = 0$ | M1 (correct equation, any form)<br><br><br><br>AG1 (correct simplification if wrong, no marks) |
| 14(c)(ii) | $(x-25)(x+28) = 0$<br>$x = 25$ *or* $x = -28$ | M1<br>A1 |
| 14(d) | *Exchange rate in 2012* $= (25+3) = 28$ *VND* | B1 |
| 15(a) | $p = -5$ | B1 |
| 15(b) | *Curve*<br>*Points*<br>*(Refer to graph)* | C1<br>P2<br>If scale is error / any error minus 1 mark |
| 15(c) | *When* $y = 3$, $x = 0.45$ or $x = -4.6$ $(\pm 0.1)$ | B1 (for both answer) |
| 15(d) | *Equation of line of symmetry:* $x = 2.5$ | B1 |

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