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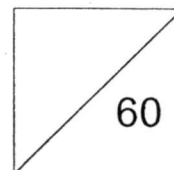
聖 嬰 中 學

HOLY INNOCENTS' HIGH SCHOOL

Name of Student

Class

Index Number



**MID-YEAR EXAMINATION 2015**  
**SECONDARY 3 EXPRESS**  
**MATHEMATICS PAPER 1**

4048/01

**Date:** 13 May 2015 (Wed)

**Duration:** 1 hr 30 min

*Additional Materials:* Nil

**Students answer on Question Paper.**

**READ THESE INSTRUCTIONS FIRST**

Write your name, class and index number 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 paper clips, glue or correction tape/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 in the space below the question.

Omission of essential working will result in loss of marks.

The total of the marks for this paper is **60**.

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  $\pi$ , use either your calculator value or 3.142.

**Set by:** Ms Goh Lay Ching

**Vetted by:** Mdm Noor Hayati

*This document consists of 14 printed pages (including cover page).*

Answer ALL questions

- 1 a) Evaluate  $\sqrt{\frac{2}{3} - 0.2}$  , giving your answer correct to 3 decimal places.

Answer (a) ..... [1]

- b) Arrange the following numbers in order starting with the smallest.

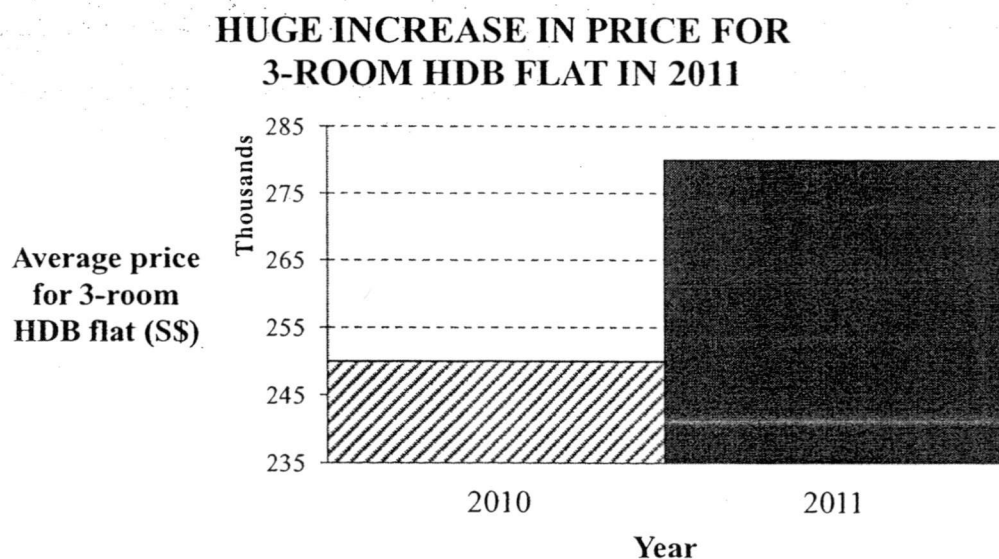
$$524 \times 10^8, 505 \times 10^9, 548 \times 10^{-10}, 0.0557 \times 10^{11}.$$

Answer (b) ..... [1]

- 2 Evaluate  $\frac{10+12+14+16+18+\dots+198}{25+30+35+40+45+\dots+495}$ .

Answer ..... [2]

- 3 The graph shows the average price for a 3-room HDB flat in 2010 and 2011.



Do you think the graph is misleading? Give your explanation supported by working.

Answer .....

.....

.....

..... [2]

- 4 Given that  $2 \leq x \leq 9$  and  $-8 \leq y < 1$ ,

a) find the least value of  $xy$ ,

Answer (a) ..... [1]

b) find the greatest value of  $\frac{2x + y^2}{x}$ .

Answer (b) ..... [1]

48

- 5 John has 48 apples, 72 oranges and 96 pears in his store room.  
John wants to pack the fruits into baskets.  
It is given that each type of fruit is distributed equally among the baskets.

a) Find the greatest number of baskets needed to pack the fruits.

Answer (a) ..... [2]

b) State the number of apples, oranges and pears in each basket.

Answer (b) ..... apples, ..... oranges, and ..... pears [1]

6 Solve the simultaneous equations

$$5x - 4y = 3,$$

$$4x - 6y = 1.$$

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

7 One of the interior angles of an octagon is  $(3x + 8)^\circ$ .

Another two angles are each  $(5x + 46)^\circ$  and the remaining angles are each  $(3x)^\circ$ .

Find the value of  $x$ .

Answer ..... [3]

---

8 A video production company needs to back up 50 sets of SD cards with storage capacity of 128 gigabytes each.

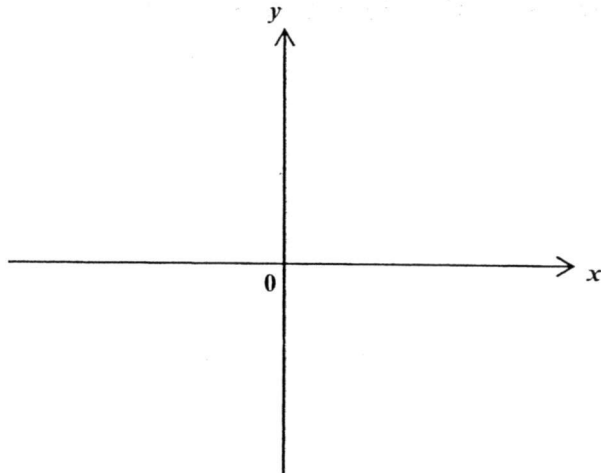
If one external hard disk has storage capacity of 2 terabytes, what is the least number of external hard disk required to back up all the data in the SD cards?

Answer ..... [3]

49

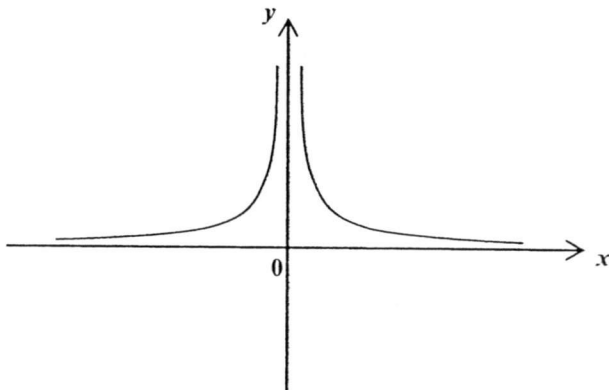
- 9 a) Sketch the graph of  $y = -x^3$ .

Answer (a)



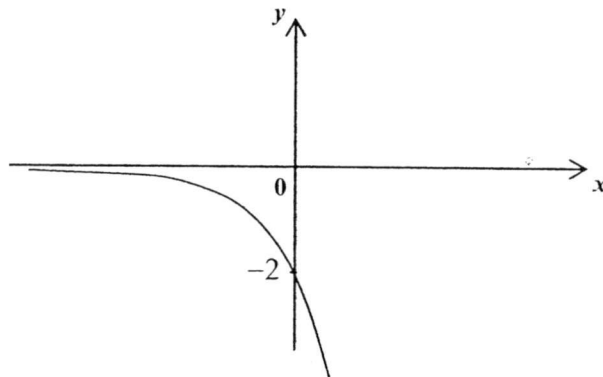
[1]

- b) The diagram below represents a sketch of the graph of  $y = x^n$ . Write down a possible value of  $n$ .



Answer (b)  $n = \dots\dots\dots$  [1]

- c) Write down a possible equation of the graph below.



Answer (c)  $\dots\dots\dots$  [1]

- 10 In the first round of a math competition, students have to answer 40 questions. 10 points are awarded for every correct answer and 5 points are deducted for every incorrect answer. Students who score at least 300 points qualify for the next round.

Assuming the number of correct answers as  $x$ ,

- a) form an inequality in  $x$ ,

Answer (a) ..... [1]

- b) solve the inequality in (a), and hence find the least number of correct answers needed to qualify for the next round.

Answer (b) ..... [2]

50

11 a) Solve  $y^{-3} = \frac{1}{216}$ .

Answer (a)  $y = \dots\dots\dots$  [2]

b) If  $7^x = 36$ , find the value of  $\frac{2}{7^2 + 3}$

Answer (b)  $\dots\dots\dots$  [2]

12 a) Simplify  $(4x^7)^4 \div 2x^2$

Answer (a) ..... [2]

b) Express  $\left(\frac{125}{8}\right)^{\frac{4}{3}}$  in the form  $\left(\frac{a}{b}\right)^n$  where  $a$  and  $b$  are prime numbers and  $n$  is an integer.

Answer (b) ..... [2]

13 Factorise completely

a)  $8y^3 - 50y$ ,

Answer (a) ..... [2]

b)  $m^2 - 3m + 2mn - 6n$  .

Answer (b) ..... [2]

- 14 A hair salon is having a promotion in May for members in celebration of Singapore's 50<sup>th</sup> birthday.  
The membership fee is \$25 and members get to enjoy the following discounts.

| Hair Service    | Service Rate | Member's discount |
|-----------------|--------------|-------------------|
| Haircut         | \$40         | 15%               |
| Scalp treatment | \$90         | 20%               |
| Hair treatment  | \$110        | 25%               |
| Rebonding       | \$230        | 30%               |

On 1 May, Lydia wants to have a haircut and hair treatment.  
Her hairstylist informs her about the promotion.

- a) Compare the rates for members and non-members.  
State if Lydia should take up the membership.  
Explain your reason(s) and show your workings clearly.

Answer (a) .....

.....

..... [2]

As Lydia's birthday falls in the month of May, the hair stylist offers her a further 20% discount on the member's price for rebonding and scalp treatment.

- b) Write down an equation for the total amount,  $T$ , that Lydia needs to pay for rebonding and scalp treatment if she returns to the salon within the month of May for both services.  
Use  $r$  and  $s$  to represent the original price of rebonding and scalp treatment respectively.

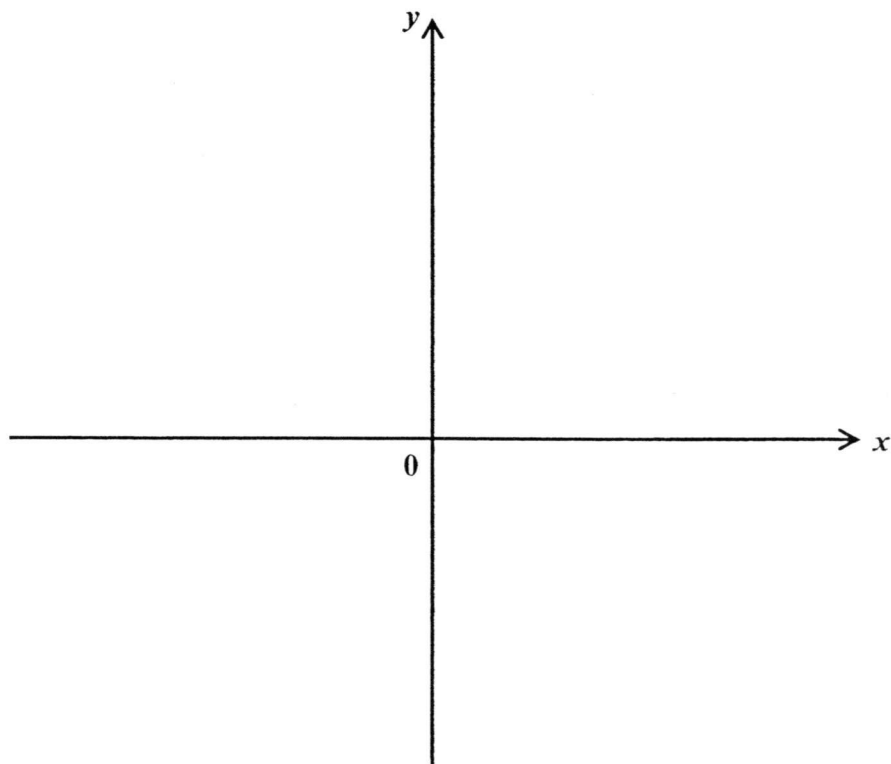
Answer (b) ..... [2]

- 15 a) Express  $y = -x^2 + 4x + 5$  in the form of  $(x - h)^2 + k$ .

Answer (a) ..... [2]

- bi) Sketch the graph of  $y = -x^2 + 4x + 5$ , showing the intercepts with the axes clearly.

Answer (bi)



[3]

- bii) Write down the equation of the line of symmetry of  $y = -x^2 + 4x + 5$ .

Answer (bii) ..... [1]

52

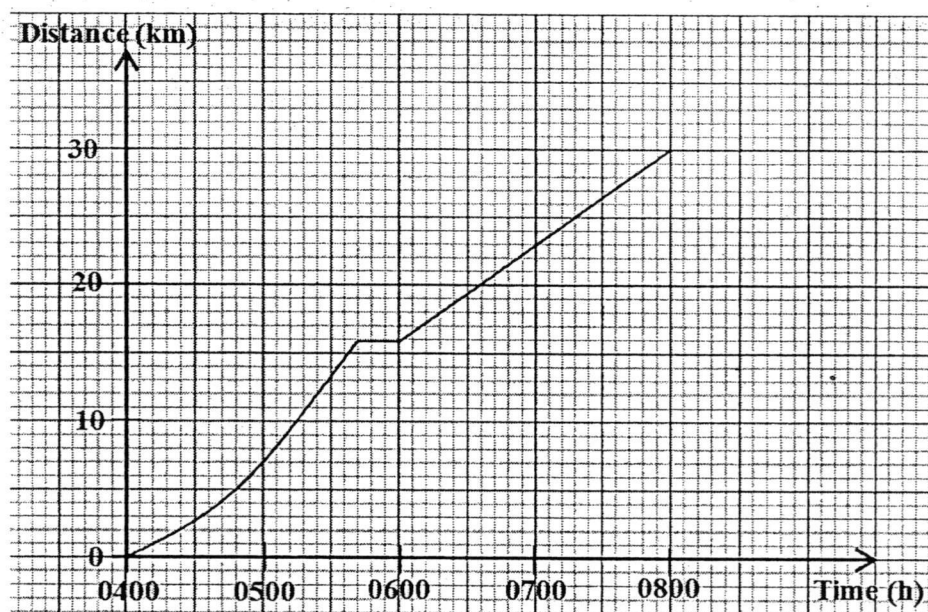
16 a) Solve  $(2x - 5)(x - 2) = 15$ .

Answer (a)  $x =$  ..... or ..... [3]

b) Solve  $\frac{2x+5}{6} - \frac{5x-3}{3} = \frac{3}{2}$ .

Answer (b)  $x =$  ..... [3]

- 17 Alyssa participated in a 30 km run last month. The distance-time graph below represents her run from the start to the end.



- a) Using Alyssa's speed, describe her run as shown in the graph above.

Answer (a) .....

.....

.....

..... [1]

- b) What is Alyssa's speed at 5 a.m.?

Answer (b) ..... km/h [2]

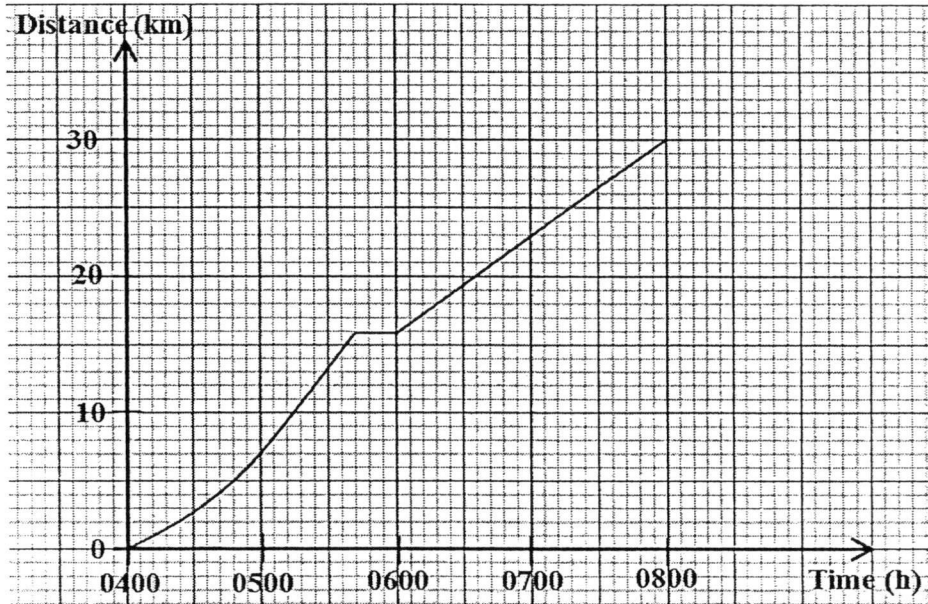
- c) Find the average speed of Alyssa's run.

Answer (c) ..... km/h [1]

53

- d) Pei Hua also took part in the same run as Alyssa. She started at the same time, ran at a constant speed and completed her run at 0736h.
- i) Draw and label Pei Hua's graph on the given distance-time graph for Alyssa below.

Answer  
(di)



[1]

- ii) At what time did Alyssa overtake Pei Hua?

Answer (dii) ..... [1]

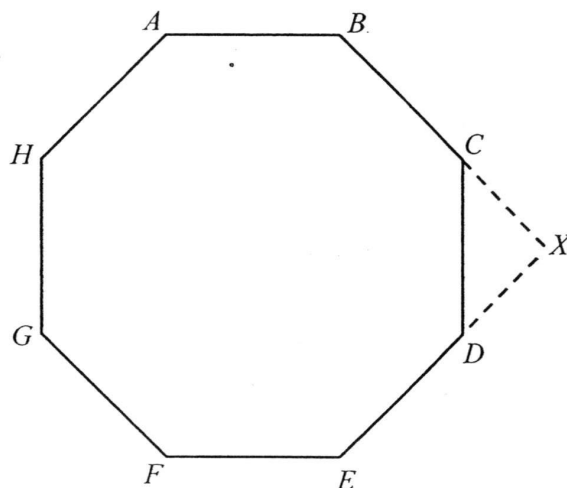
**End of Paper**





Answer all questions.

- 1 (a) The interior angle of a regular polygon is nine times that of its exterior angle.  
Find the number of sides of this polygon. [2]
- (b) The figure shows a regular octagon  $ABCDEFGH$ .  
The lines  $BC$  and  $ED$  produced meet at  $X$ .  
Calculate



- (i) the size of each interior angle of the octagon, [2]
- (ii) angle  $DCX$ , [1]
- (iii) angle  $CXD$ . [1]

- 2 (a) Simplify  $\frac{4x+8}{x^2+5x+6}$ . [2]
- (b) Given that  $\frac{1}{u} = \frac{1}{f} + \frac{1}{2v}$ , express  $v$  in terms of  $u$  and  $f$ . [2]
- (c) Factorise  $4(9a^2c - b^2c + 9a^2d) - 4b^2d$ . [3]
- (d) Given that  $2y - 2x = x + y$ , find the value(s) of  $\sqrt{\frac{4y^2}{x^2 + 2xy}}$ . [3]

- 3 Thomas plans to save \$10 000 in a bank for 5 years. The bank offers him two investment plans.

Plan A

The bank pays 5.5% simple interest per year for the whole of the 5 years.

Plan B

The bank pays interest **compounded monthly** at the rate of 5% per annum for one year. The bank then pays interest **compounded yearly** at the same rate of 5% per annum for the next 4 years.

- (a) Calculate the amount of money Thomas will have at the end of 5 years if he chooses
- (i) Plan A, [2]
- (ii) Plan B. [3]
- (b) Which plan should Thomas choose? Explain why. [1]
- 

- 4 The table below shows the time (in minutes) spent by 20 pupils on the internet each day.

|    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|
| 8  | 34 | 25 | 33 | 30 | 12 | 23 | 25 | 22 | 16 |
| 40 | 9  | 40 | 10 | 25 | 17 | 17 | 13 | 21 | 15 |

A stem-and-leaf diagram was constructed using data from 3 students.

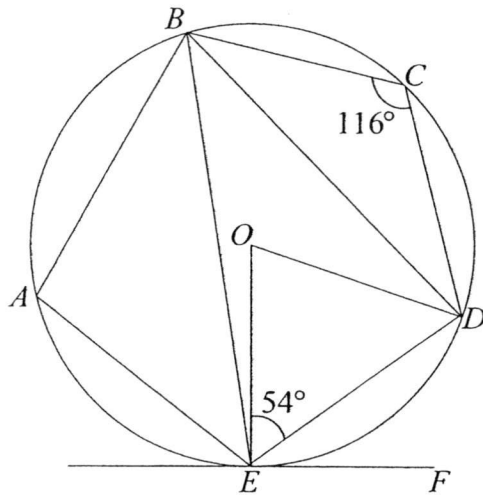
| Stem | Leaf |   |  |
|------|------|---|--|
| 0    | 8    | 9 |  |
| 1    | 2    |   |  |

0| 8 represents 8 minutes

- (a) Copy and complete the stem-and-leaf diagram for all 20 students. [2]
- (b) Find the
- (i) mean, [1]
- (ii) mode, [1]
- (iii) median. [1]
-

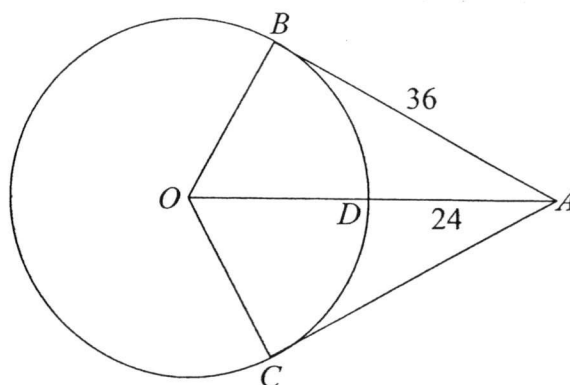
- 5 (a) It is given that  $y$  is directly proportional to  $(x - 5)^3$ .  
When  $y = 1$ ,  $x = 7$ .  
Find
- (i) an equation connecting  $y$  and  $x$ , [1]
  - (ii) the value of  $y$  when  $x = 2$ , [1]
  - (iii) the value of  $x$  when  $y = 3$ . [2]
- (b) An island represented by an area of  $2000 \text{ cm}^2$  on a map has an actual area of  $500 \text{ km}^2$ .
- (i) Find the actual area of a pond represented by  $150 \text{ cm}^2$  on the map. [1]
  - (ii) Express the scale of the map in the form  $1 : n$ . [2]

- 6 (a) In the diagram  $A, B, C, D$  and  $E$  lie on a circle centre  $O$ .  
Angle  $BCD = 116^\circ$  and angle  $OED = 54^\circ$ .  
 $EF$  is tangent to the circle at  $E$ .



- Find
- (i) angle  $DOE$ , [1]
  - (ii) angle  $DBE$ , [1]
  - (iii) angle  $DEF$ , [1]
  - (iv) angle  $OEB$ , [1]
  - (v) angle  $BAE$ . [2]

- (b) In the diagram,  $AB$  and  $AC$  are tangents to the circle with centre  $O$  at the points  $B$  and  $C$  respectively.



Given that  $AB = 36$  cm,  $AD = 24$  cm, find

- (i) the radius of the circle, [2]  
(ii) the area of the quadrilateral  $ABOC$ . [2]
-

- 7 Numbers are written out in three columns to make the following patterns.

|         | Column 1 | Column 2 | Column 3 |
|---------|----------|----------|----------|
| Row 1   | -143     | 2        | 1        |
| Row 2   | -138     | 8        | 8        |
| Row 3   | -133     | 18       | 27       |
| Row 4   | -128     | 32       | 64       |
| Row 5   | $p$      | $q$      | $r$      |
|         |          |          |          |
| Row $n$ | $x$      | $y$      | $z$      |

- (a) Study the patterns and write down the value of
- (i)  $p$ , [1]
  - (ii)  $q$ , [1]
  - (iii)  $r$ . [1]
- (b) Find expressions, in terms of  $n$ , for each of  $x$ ,  $y$  and  $z$ . [3]
- (c) It is given that Row  $m$ , Column 2 contains the first term which is greater than 900.  
Find the value of  $m$ . [1]
- (d) It is given that Row  $k$ , Column 1 contains the first positive term.  
Find the value of  $k$ . [1]
- (e) Explain why 1727 cannot be found in column 3. [1]

57

8 Factory  $A$  can manufacture a machine part every  $x$  minutes.

(a) Write down an expression, in terms of  $x$ , for the number of parts that Factory  $A$  can manufacture in one hour. [1]

(b) Factory  $B$  takes half a minute less to manufacture the same machine part. Write down an expression, in terms of  $x$ , for the number of parts that Factory  $B$  can manufacture in one hour. [1]

(c) Both factories can produce a total of 56 parts in one hour. Form an equation in terms of  $x$  and show that it reduces to  $28x^2 - 74x + 15 = 0$ . [3]

(d) Solve the equation  $28x^2 - 74x + 15 = 0$ , giving your answers correct to two decimal places. [4]

(e) Calculate the time that Factory  $A$  will take to produce 300 parts, giving your answer in hours, minutes and seconds. [2]

9 In Russia, four nuclear reactors exploded, resulting in a radiation leak.

Radiation is measured in units called 'Sieverts' (Sv).

Each of the reactors produced  $2.1 \times 10^4$  Sv of radiation at the source of the radiation leak.

The amount of radiation present decreases as the distance from the source increases.

The amount of radiation  $A$  present is given by the formula:

$$A = \frac{(5 \times 10^{-2})(A_0)}{r^2}$$

where  $A_0$  is the original amount of radiation and  $r$  is the distance away from the source of the radiation leak in km.

5 Sv of radiation is enough to kill a person.

The Russian government proposes setting up a circular safety zone with a radius of 25 km around the source of the radiation leak.

An expert on radiation feels that the safety zone should be larger.

With appropriate calculations, discuss whether the expert is right, and if so, how much larger the safety zone should be. [4]

- 10 The variables  $x$  and  $y$  are connected by the equation  $y = 2x + \frac{15}{x} - 10$ .

Some corresponding values of  $x$  and  $y$ , correct to 1 decimal place are given in the table below.

|     |   |     |     |   |     |   |     |     |     |
|-----|---|-----|-----|---|-----|---|-----|-----|-----|
| $x$ | 1 | 1.5 | 2   | 3 | 4   | 5 | 6   | 7   | 8   |
| $y$ | 7 | 3   | 1.5 | 1 | 1.8 | 3 | $a$ | 6.1 | 7.9 |

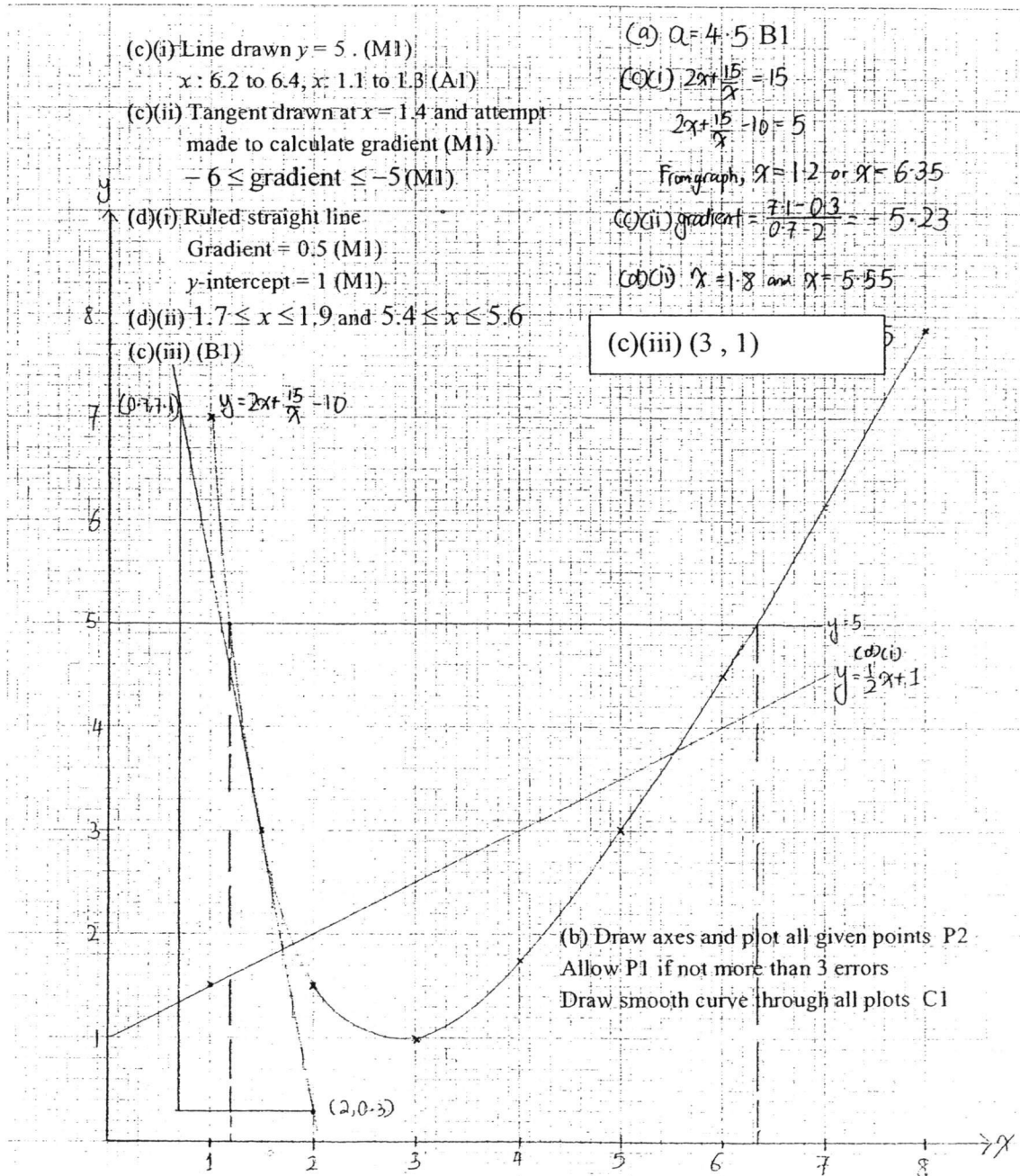
- (a) Calculate the value of  $a$ . [1]
- (b) Taking 2 cm to represent 1 unit on both axes, draw the graph of  $y = 2x + \frac{15}{x} - 10$  for  $1 \leq x \leq 8$ . [3]
- (c) Use your graph to find
- (i) the solution(s) of the equation  $2x + \frac{15}{x} = 15$ , [2]
  - (ii) the gradient of the curve at  $x = 1.4$ , [2]
  - (iii) the coordinates of the minimum point. [1]
- (d) (i) On the same axes, draw the graph of  $y = \frac{1}{2}x + 1$ . [2]
- (ii) State the  $x$ -coordinates of the intersection points between  $y = 2x + \frac{15}{x} - 10$  and  $y = \frac{1}{2}x + 1$ . [1]

----- *End of Paper 2* -----

## Secondary 3 Express Mathematics 2015 MYE, Paper 2

| Question  |                                                                                                                                                                                                                                                                                                                                                                           |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|---|---|---|---|--|--|--|--|---|---|---|--|--|--|--|--|
| 1(a)      | 20                                                                                                                                                                                                                                                                                                                                                                        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 1(b)(i)   | $135^\circ$                                                                                                                                                                                                                                                                                                                                                               |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 1(b)(ii)  | $45^\circ$                                                                                                                                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 1(b)(iii) | $90^\circ$                                                                                                                                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 2(a)      | $\frac{4}{(x+3)}$                                                                                                                                                                                                                                                                                                                                                         |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 2(b)      | $v = \frac{uf}{2f - 2u}$                                                                                                                                                                                                                                                                                                                                                  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 2(c)      | $4(c+d)(3a+b)(3a-b)$                                                                                                                                                                                                                                                                                                                                                      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 2(d)      | 2.27                                                                                                                                                                                                                                                                                                                                                                      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 3(a)(i)   | Amount = \$12750                                                                                                                                                                                                                                                                                                                                                          |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 3(a)(ii)  | $A = \$12776.94$                                                                                                                                                                                                                                                                                                                                                          |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 3(b)      | Plan B. He will receive \$26.94 more interest with Plan B.                                                                                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 4(a)      | <table><tr><td>1</td><td>0</td><td>2</td><td>3</td><td>5</td><td>6</td><td>7</td><td>7</td></tr><tr><td>2</td><td>1</td><td>2</td><td>3</td><td>5</td><td>5</td><td>5</td><td></td></tr><tr><td>3</td><td>0</td><td>3</td><td>4</td><td></td><td></td><td></td><td></td></tr><tr><td>4</td><td>0</td><td>0</td><td></td><td></td><td></td><td></td><td></td></tr></table> | 1 | 0 | 2 | 3 | 5 | 6 | 7 | 7 | 2 | 1 | 2 | 3 | 5 | 5 | 5 |  | 3 | 0 | 3 | 4 |  |  |  |  | 4 | 0 | 0 |  |  |  |  |  |
| 1         | 0                                                                                                                                                                                                                                                                                                                                                                         | 2 | 3 | 5 | 6 | 7 | 7 |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 2         | 1                                                                                                                                                                                                                                                                                                                                                                         | 2 | 3 | 5 | 5 | 5 |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 3         | 0                                                                                                                                                                                                                                                                                                                                                                         | 3 | 4 |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 4         | 0                                                                                                                                                                                                                                                                                                                                                                         | 0 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 4(b)(i)   | Mean = 21.75                                                                                                                                                                                                                                                                                                                                                              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 4(b)(ii)  | Mode = 25                                                                                                                                                                                                                                                                                                                                                                 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 4(b)(iii) | Median = 21.5                                                                                                                                                                                                                                                                                                                                                             |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 5(a)(i)   | $y = \frac{1}{8}(x-5)^3$                                                                                                                                                                                                                                                                                                                                                  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 5(a)(ii)  | $y = -3\frac{3}{8}$                                                                                                                                                                                                                                                                                                                                                       |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 5(a)(iii) | $x = 7.88$                                                                                                                                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 5(b)(i)   | Area = $37.5 \text{ km}^2$                                                                                                                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 5(b)(ii)  | Area Scale = 1 : 50000                                                                                                                                                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 6(a)(i)   | $72^\circ$                                                                                                                                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 6(a)(ii)  | $36^\circ$                                                                                                                                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 6(a)(iii) | $36^\circ$                                                                                                                                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 6(a)(iv)  | $10^\circ$                                                                                                                                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 6(a)(v)   | $100^\circ$                                                                                                                                                                                                                                                                                                                                                               |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 6(b)(i)   | $r = 15$                                                                                                                                                                                                                                                                                                                                                                  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 6(b)(ii)  | $540 \text{ cm}^2$                                                                                                                                                                                                                                                                                                                                                        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 7(a)(i)   | -123                                                                                                                                                                                                                                                                                                                                                                      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 7(a)(ii)  | 50                                                                                                                                                                                                                                                                                                                                                                        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 7(a)(iii) | 125                                                                                                                                                                                                                                                                                                                                                                       |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |
| 7(b)      | $z = n^3$                                                                                                                                                                                                                                                                                                                                                                 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |

|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7(c) | $m = 22$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 7(d) | $k = 30$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 7(e) | The numbers in column 3 are cubic numbers. 1727 is not.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 8(a) | $\frac{60}{x}$ parts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 8(b) | $\frac{60}{x - \frac{1}{2}} = \frac{120}{2x - 1}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 8(c) | $\frac{60}{x} + \frac{120}{2x - 1} = 56$ $60(2x - 1) + 120x = 56x(2x - 1)$ $120x - 60 + 120x = 112x^2 - 56x$ $112x^2 - 296x + 60 = 0$ $28x^2 - 74x + 15 = 0 \text{ (Shown)}$                                                                                                                                                                                                                                                                                                                                                                           |
| 8(d) | $x = 2.42$ or $x = 0.22$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 8(e) | 12 h 6 min 28.8 sec                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 9    | <p>Total Sv at source = <math>4(2.1 \times 10^4) = 8.4 \times 10^4</math></p> <p>Amount of radiation at 25 km</p> $= \frac{5 \times 10^{-2} \times 8.4 \times 10^4}{25^2}$ $= 6.72$ <p>The safety radius is too small, the expert is right.</p> <p>Let appropriate radius be <math>r</math>,</p> $5 = \frac{5 \times 10^{-2} \times 8.4 \times 10^4}{r^2}$ $r = \sqrt{\frac{5 \times 10^{-2} \times 8.4 \times 10^4}{5}}$ $r^2 = 840$ $r = 28.982$ $r = 29$ <p><math>29 - 25 = 4</math> km</p> <p>The radius should be increased by at least 4 km.</p> |



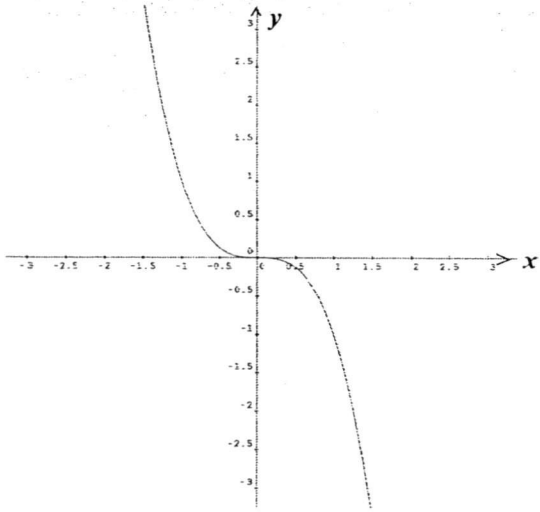




Marking Scheme 2015 (Sec 3 Express Paper 1)

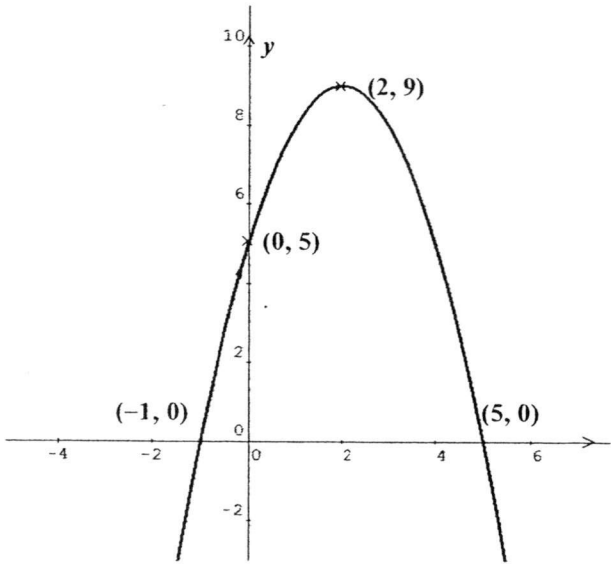
| Qn  | Working                                                                                                                                                                                                                                                                                                                                                                            | Marks Allocation | Remarks                                                                                        |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------------------------------------------------------------------------------------|
| 1a) | $\sqrt{\frac{\frac{2}{3} - 0.2}{3.03}} = \sqrt{0.154015}$ $\approx 0.392$                                                                                                                                                                                                                                                                                                          | [B1]             |                                                                                                |
| 1b) | $548 \times 10^{-10}, 0.0557 \times 10^{11}, 524 \times 10^8, 505 \times 10^9$                                                                                                                                                                                                                                                                                                     | [B1]             |                                                                                                |
| 2)  | $\frac{10+12+14+16+18+\dots+198}{25+30+35+40+45+\dots+495}$ $= \frac{2(5+6+7+8+9+\dots+99)}{5(5+6+7+8+9+\dots+99)}$ $= \frac{2}{5}$                                                                                                                                                                                                                                                | [M1]<br>[A1]     |                                                                                                |
| 3)  | <p>Yes.</p> <p>The increase in price is 12% but from the graph, it seems more than 50% increase.</p> <p>This is because the axis for price does not start from 0.</p> <p>Title is biased – does not allow reader to make own judgment</p>                                                                                                                                          | [B1], [B1]       | Award one mark for misleading feature and one mark for the effect of this feature on the graph |
| 4a) | $9(-8) = -72$                                                                                                                                                                                                                                                                                                                                                                      | [B1]             |                                                                                                |
| 4b) | <p>When <math>x = 2</math> and <math>y = -8</math>,</p> $\frac{2(2) + (-8)^2}{2} = 34$                                                                                                                                                                                                                                                                                             | [B1]             |                                                                                                |
| 5a) | $48 = 2^4 \times 3$ [M1]      OR $48 = 2 \times 2 \times 2 \times 2 \times 3$ [M1]<br>$72 = 2^3 \times 3^2$ $72 = 2 \times 2 \times 2 \times 3 \times 3$<br>$96 = 2^5 \times 3$ $96 = 2 \times 2 \times 2 \times 2 \times 2 \times 3$<br><hr/> $\text{H.C.F} = 2^3 \times 3$ $\text{H.C.F} = 2 \times 2 \times 2 \times 3$<br>$= 24$ [A1] $= 24$                                   | [A1]             | Award [M1] when students choose H.C.F.                                                         |
|     | The greatest number of baskets that John can pack is 24.                                                                                                                                                                                                                                                                                                                           |                  |                                                                                                |
| 5b) | <p>No. of apples = <math>\frac{48}{24}</math></p> <p style="margin-left: 100px;"><math>= 2</math></p> <p>No. of oranges = <math>\frac{72}{24}</math></p> <p style="margin-left: 100px;"><math>= 3</math></p> <p>No. of pears = <math>\frac{96}{24}</math></p> <p style="margin-left: 100px;"><math>= 4</math></p> <p>There are 2 apples, 3 oranges and 4 pears in each basket.</p> | [B1]             | 61                                                                                             |

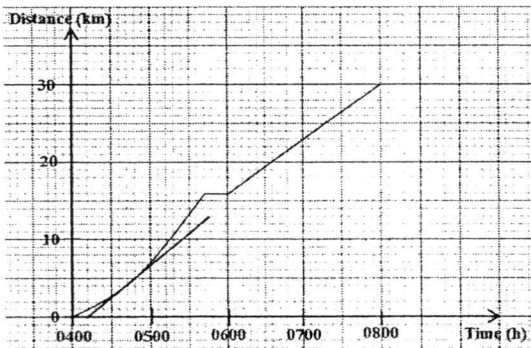
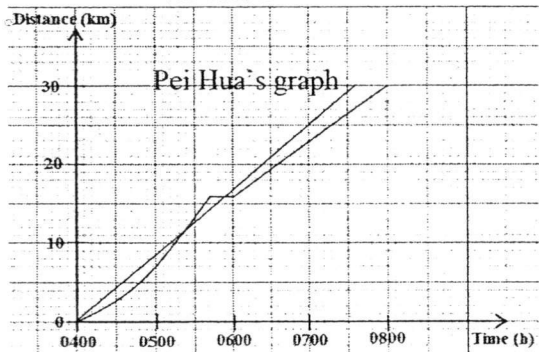
| Qn | Working                                                                                                                                                                                                                                                                                                                                                     | Marks Allocation                                                                                                                     | Remarks                                                                                                                                                                                                                             |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6  | $5x - 4y = 3$ -----(1)<br>$4x - 6y = 1$ -----(2)<br><br>$(1) \times 4 \quad 20x - 16y = 12$ -----(3)<br><br>$(2) \times 5 \quad 20x - 30y = 5$ -----(4)<br><br>$(3) - (4) \quad -16y + 30y = 12 - 5$<br>$14y = 7$<br>$y = \frac{1}{2}$<br><br>sub $y = \frac{1}{2}$ into (1)<br>$5x - 4\left(\frac{1}{2}\right) = 3$<br>$5x - 2 = 3$<br>$5x = 5$<br>$x = 1$ | <br><br><br><br><br><br><br><br><br><br>[M1]<br><br><br><br><br><br><br><br><br><br>[A1]                                             | <br><br><br><br><br><br><br><br><br><br>for eliminating unknown<br><br><br><br><br><br><br><br><br><br>                                                                                                                             |
| 7  | Sum of interior angle $= (8 - 2) \times 180^\circ$<br>$= 1080^\circ$<br><br>$3x + 8 + 2(5x + 46) + 5(3x) = 1080$<br>$3x + 8 + 10x + 92 + 15x = 1080$<br>$28x + 100 = 1080$<br>$28x = 980$<br>$x = 35$                                                                                                                                                       | <br><br><br><br><br><br><br><br><br><br>[M1]<br><br><br><br><br><br><br><br><br><br>[M1]<br><br><br><br><br><br><br><br><br><br>[A1] | <br><br><br><br><br><br><br><br><br><br>for forming eqn<br><br><br><br><br><br><br><br><br><br>                                                                                                                                     |
| 8  | Number of external hard disks<br>$= \frac{50 \times 128 \times 10^9}{2 \times 10^{12}}$<br>$= 3.2$<br><br>$\therefore$ The company has to purchase a minimum of 4 external hard disks.                                                                                                                                                                      | <br><br><br><br><br><br><br><br><br><br>[M1]<br><br><br><br><br><br><br><br><br><br>[M1]<br><br><br><br><br><br><br><br><br><br>[A1] | Working w/o calculator<br><br><br><br><br><br><br><br><br><br>$= \frac{50 \times 128 \times 10^9}{2 \times 10^{12}}$<br>$= \frac{6400 \times 10^9}{2 \times 10^{12}}$<br>$= \frac{6.4 \times 10^{12}}{2 \times 10^{12}}$<br>$= 3.2$ |

| Qn   | Working                                                                                                                          | Marks Allocation | Remarks                                                                    |
|------|----------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------------------------------------------------------------|
|      | $y = -x^3$                                                                                                                       |                  |                                                                            |
| 9a)  |                                                 | [B1]             |                                                                            |
| 9b)  | -2                                                                                                                               | [B1]             | accept any negative even number (e.g. -4, -6...)                           |
| 9c)  | $y = (-2)2^x$                                                                                                                    | [B1]             | Accept any exponential function that cuts y-axis at -2 and is below x-axis |
| 10a) | $10(x) - 5(40 - x) \geq 300$                                                                                                     | [B1]             | Accept if students simplify the inequality                                 |
| 10b) | $10(x) - 5(40 - x) \geq 300$<br>$10x - 200 + 5x \geq 300$<br>$15x \geq 500$<br>$x \geq \frac{500}{15}$<br>$x \geq 33\frac{1}{3}$ | [M1]             | Give method mark if students are able to show till the last step           |
|      | The least number of correct answers is 34.                                                                                       | [A1]             |                                                                            |

62

| Qn   | Working                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Marks Allocation | Remarks |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------|
| 11a) | $y^{-3} = \frac{1}{216}$<br>$y^{-3} = 6^{-3}$<br>Comparing the index,<br>$y = 6$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | [M1]<br><br>[A1] |         |
| 11b) | $\frac{2}{\frac{x}{7^2+3}}$<br>$= \frac{2}{(7^x)^{\frac{1}{2}}+3}$<br>$= \frac{2}{(36)^{\frac{1}{2}}+3}$<br>$= \frac{2}{6+3}$<br>$= \frac{2}{9}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | [M1]<br><br>[A1] |         |
| 12a) | $(4x^7)^4 \div 2x^2$<br>$= 256x^{28} \div 2x^2$<br>$= 128x^{26}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | [M1]<br><br>[A1] |         |
| 12b) | <div> <div> <math>\left(\frac{125}{8}\right)^{\frac{4}{3}}</math><br/> <math>= \left(\sqrt[3]{\frac{125}{8}}\right)^4</math><br/> <math>= \left(\frac{5}{2}\right)^4</math> </div> <div> <u>Alternative method 1:</u><br/> <math>\left(\frac{125}{8}\right)^{\frac{4}{3}}</math><br/> <math>= \frac{(5^3)^{\frac{4}{3}}}{(2^3)^{\frac{4}{3}}}</math><br/> <math>= \frac{5^4}{2^4} = \left(\frac{5}{2}\right)^4</math> </div> <div> <u>Alternative method 2:</u><br/> Using calculator to evaluate<br/> <math>\left(\frac{125}{8}\right)^{\frac{4}{3}} = \frac{625}{16}</math><br/> <math>= \left(\frac{5}{2}\right)^4</math> </div> </div> | [M1]<br><br>[A1] |         |
| 13a) | $8y^3 - 50y$<br>$= 2y(4y^2 - 25)$<br>$= 2y(2y+5)(2y-5)$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | [M1]<br><br>[A1] |         |
| 13b) | $m^2 - 3m + 2mn - 6n$<br>$= m(m-3) + 2n(m-3)$<br>$= (m+2n)(m-3)$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | [M1]<br><br>[A1] |         |

| Qn   | Working                                                                                                                                                                                                                                                                                                                                                                                                    | Marks Allocation                                                                                                                             | Remarks                                                                                                                                                                     |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 14a) | <p>Before joining as member:<br/> Total amount = \$40 + \$110<br/> = \$150</p> <p>After joining as member:</p> <p>Total amount = <math>0.85(\\$40) + 0.75(\\$110) + \\$25</math><br/> = \$34 + \$82.50 + \$25<br/> = \$141.50</p> <p>Savings = \$150 - \$141.50<br/> = \$8.50</p> <p>Lydia should take up the membership as she will save \$8.50 if she joins as member, including the membership fee.</p> | <p>[M1]</p> <p>[A1] for reason</p>                                                                                                           | <p>Award [M1] as long as students are able to show that there are savings as a member.</p> <p>Any answer giving reason that suggests paying a lower amount as a member.</p> |
| 14b) | $T = 0.8(0.7r) + 0.8(0.8s)$<br>$T = 0.56r + 0.64s$                                                                                                                                                                                                                                                                                                                                                         | [B2]                                                                                                                                         | <p>[B1] for <math>0.8 \times 0.7r</math> or <math>0.8 \times 0.8s</math> s.o.i.</p>                                                                                         |
| 15a) | $y = -(x^2 - 4x - 5)$<br>$= -[x^2 - 4x + \left(-\frac{4}{2}\right)^2 - \left(-\frac{4}{2}\right)^2 - 5]$<br>$= -[(x-2)^2 - 9]$<br>$= -(x-2)^2 + 9$                                                                                                                                                                                                                                                         | <p>[M1]</p> <p>[A1]</p>                                                                                                                      |                                                                                                                                                                             |
| bi)  | <p>Max point = (2, 9)</p> <p>When <math>x = 0</math>,<br/> <math>y = 5</math></p> <p>When <math>y = 0</math>,<br/> <math>0 = -(x-2)^2 + 9</math><br/> <math>(x-2)^2 = 9</math><br/> <math>x = 5</math> or <math>x = -1</math></p>                                                                                                                                                                          |                                                                                                                                              |                                                                                                                                                                             |
| bi)  |  <p><math>y = -x^2 + 4x + 5</math></p>                                                                                                                                                                                                                                                                                  | <p>Attempt at parabola through (0, 5)-----[B1]</p> <p>Turning point at (2, 9) --- [B1]</p> <p>Graph cutting x-axis at -1 and 5 -----[B1]</p> |                                                                                                                                                                             |
| bii) | $x = 2$                                                                                                                                                                                                                                                                                                                                                                                                    | [B1]                                                                                                                                         |                                                                                                                                                                             |

| Qn   | Working                                                                                                                                                   | Marks Allocation        | Remarks                                                                        |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------------------------------------------|
| 16a) | $(2x-5)(x-2)=15$<br>$2x^2-4x-5x+10=15$<br>$2x^2-9x-5=0$<br>$(2x+1)(x-5)=0$<br>$x=-\frac{1}{2}$ or $x=5$                                                   | [M1]<br>[M1]<br>[A1]    | For correct expansion<br>For correct expansion<br>Both answers must be correct |
| 16b) | $\frac{2x+5}{6} - \frac{5x-3}{3} = \frac{3}{2}$<br>$2x+5-2(5x-3)=9$<br>$2x+5-10x+6=9$<br>$-8x=-2$<br>$x=\frac{1}{4}$                                      | [M1]<br>[M1]<br>[A1]    |                                                                                |
| 17a) | She ran at an <b>increasing speed</b> from 4 a.m. to 5.42 a.m. She <b>stopped</b> for 36 min before continuing at a <b>uniform speed</b> from 6am to 8am. | [B1]                    | Any reasonable description that fit the 3 parts of the graph                   |
| b)   |                                                                        | [M1]                    | Award one mark if student draws a tangent to the graph at the required time    |
|      | Gradient of tangent = $\frac{20}{1\frac{1}{60}} = 11\frac{1}{9}$                                                                                          | [A1]                    | Calculation of gradient                                                        |
| c)   | Av Speed = $\frac{30}{4}$<br>$= 7.5 \text{ km/h}$                                                                                                         | [B1]                    |                                                                                |
| di)  |                                                                        | D-T graph drawn<br>[B1] |                                                                                |
| dii) | 0518h or 5.18am                                                                                                                                           | [B1]                    | Accept $\pm 1$ square's reading                                                |

Answer Scheme

Secondary 3 Express Mathematics 2015 MYE, Paper 2

| Question  | Working                                                                                                                                                                                            | Marks/Remarks                                                                       |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1(a)      | <p>Let exterior angle be <math>x</math> and interior angle be <math>9x</math></p> $9x + x = 180^\circ$ $10x = 180^\circ$ $x = 18^\circ$ <p>Number of sides =</p> $\frac{360^\circ}{18^\circ} = 20$ | <p>M1</p> <p>A1</p>                                                                 |
| 1(b)(i)   | $\frac{(n-2)180^\circ}{8}$ $= 135^\circ$ <p>Alternatively</p> $\text{Exterior Angle} = \frac{360^\circ}{8} = 45^\circ$ $\text{Interior Angle} = 180^\circ - 45^\circ = 135^\circ$                  | <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p>                                             |
| 1(b)(ii)  | Angle $DCX = 180^\circ - 135^\circ = 45^\circ$                                                                                                                                                     | B1                                                                                  |
| 1(b)(iii) | Angle $CXD = 180^\circ - 45^\circ - 45^\circ = 90^\circ$                                                                                                                                           | B1                                                                                  |
| 2(a)      | $\frac{4(x+2)}{(x+3)(x+2)}$ $= \frac{4}{(x+3)}$                                                                                                                                                    | <p>M1</p> <p>A1</p>                                                                 |
| 2(b)      | $\frac{1}{u} = \frac{2v+f}{2vf}$ $2vf = 2uv + uf$ $2vf - 2uv = uf$ $v(2f - 2u) = uf$ $v = \frac{uf}{2f - 2u}$ <p>Accept <math>v = \frac{uf}{2(f - u)}</math> or equivalent.</p>                    | <p>M1: Expresses RHS as a single fraction</p> <p>A1</p>                             |
| 2(c)      | $36a^2c - 4b^2c + 36a^2d - 4b^2d$ $= 36a^2(c + d) - 4b^2(c + d)$ $= (c + d)(36a^2 - 4b^2)$ $= 4(c + d)(3a + b)(3a - b)$                                                                            | <p>M1: Expands</p> <p>M1: Factorisation by grouping</p> <p>A1: Fully Factorised</p> |

|          |                                                                                                                                                                                                                                                                                                                                                                           |                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |                                      |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|---|---|---|---|--|--|--|--|---|---|---|--|--|--|--|--|--------------------------------------|
|          | <p>Alternatively</p> $4[9a^2c - b^2c + 9a^2d - b^2d]$ $= 4[c(9a^2 - b^2) + d(9a^2 - b^2)]$ $= 4(c + d)(9a^2 - b^2)$ $4(3a + b)(3a - b)(c + d)$                                                                                                                                                                                                                            | M1:Factorises common factor<br>M1:Factorisation by grouping<br>A1:Fully Factorised |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |                                      |
| 2(d)     | <p><math>y = 3x</math></p> $\sqrt{\frac{4(3x)^2}{x^2 + 6x^2}}$ $= \sqrt{\frac{36x^2}{7x^2}}$ $= \sqrt{\frac{36}{7}}$ $= 2.27$                                                                                                                                                                                                                                             | M1<br><br>M1: Appropriate substitution<br><br>A1                                   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |                                      |
| 3(a)(i)  | $I = \frac{(10000)(5.5)(5)}{100} = \$2750$ <p>Amount = 10000 + 2750 = \$12750</p>                                                                                                                                                                                                                                                                                         | M1<br><br>A1                                                                       |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |                                      |
| 3(a)(ii) | <p>After 1 year,</p> $A = 10000 \left(1 + \frac{5 \cdot 12}{100}\right)^{12}$ <p><math>A = 10511.61898</math></p> <p>At the end of 5 years,</p> $A = 10511.61898 \left(1 + \frac{5}{100}\right)^4$ <p><math>A = \\$12776.94</math></p>                                                                                                                                    | M1<br><br>M1<br><br>A1                                                             |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |                                      |
| 3(b)     | Plan B. He will receive \$26.94 more interest with Plan B.                                                                                                                                                                                                                                                                                                                | B1                                                                                 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |                                      |
| 4(a)     | <table><tr><td>1</td><td>0</td><td>2</td><td>3</td><td>5</td><td>6</td><td>7</td><td>7</td></tr><tr><td>2</td><td>1</td><td>2</td><td>3</td><td>5</td><td>5</td><td>5</td><td></td></tr><tr><td>3</td><td>0</td><td>3</td><td>4</td><td></td><td></td><td></td><td></td></tr><tr><td>4</td><td>0</td><td>0</td><td></td><td></td><td></td><td></td><td></td></tr></table> | 1                                                                                  | 0 | 2 | 3 | 5 | 6 | 7 | 7 | 2 | 1 | 2 | 3 | 5 | 5 | 5 |  | 3 | 0 | 3 | 4 |  |  |  |  | 4 | 0 | 0 |  |  |  |  |  | B2: Minus one mark for each mistake. |
| 1        | 0                                                                                                                                                                                                                                                                                                                                                                         | 2                                                                                  | 3 | 5 | 6 | 7 | 7 |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |                                      |
| 2        | 1                                                                                                                                                                                                                                                                                                                                                                         | 2                                                                                  | 3 | 5 | 5 | 5 |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |                                      |
| 3        | 0                                                                                                                                                                                                                                                                                                                                                                         | 3                                                                                  | 4 |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |                                      |
| 4        | 0                                                                                                                                                                                                                                                                                                                                                                         | 0                                                                                  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |  |  |  |  |   |   |   |  |  |  |  |  |                                      |

|           |                                                                                                                                                                                                                               |                                                         |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| 4(b)(i)   | Mean<br>$= \frac{435}{20}$ $= 21.75$                                                                                                                                                                                          | B1                                                      |
| 4(b)(ii)  | Mode = 25                                                                                                                                                                                                                     | B1                                                      |
| 4(b)(iii) | Median<br>$= \frac{21 + 22}{2}$ $= 21.5$                                                                                                                                                                                      | B1                                                      |
| 5(a)(i)   | $y = k(x - 5)^3$ $1 = k(7 - 5)^3$ $k = \frac{1}{8}$ $y = \frac{1}{8}(x - 5)^3$                                                                                                                                                | B1                                                      |
| 5(a)(ii)  | $y = \frac{1}{8}(2 - 5)^3$ $y = -\frac{27}{8}$ $y = -3\frac{3}{8}$                                                                                                                                                            | B1                                                      |
| 5(a)(iii) | $3 = \frac{1}{8}(x - 5)^3$ $(x - 5)^3 = 24$ $x = \sqrt[3]{24} + 5$ $x = 7.88$                                                                                                                                                 | M1<br><br><br><br>A1                                    |
| 5(b)(i)   | Area<br>$\frac{500}{2000} \times 150 = 37.5 \text{ km}^2$                                                                                                                                                                     | B1                                                      |
| 5(b)(ii)  | $2000 \text{ cm}^2 : 500 \text{ km}^2$ $= 4 \text{ cm}^2 : 1 \text{ km}^2$ $\text{Area Scale} = \sqrt{4} \text{ cm} : \sqrt{1} \text{ km}$ $= 2 \text{ cm} : 1 \text{ km}$ $= 2 \text{ cm} : 100000 \text{ cm}$ $= 1 : 50000$ | M1: Square roots to obtain Area Scale<br><br><br><br>A1 |
| 6(a)(i)   | $\angle DOE = 180^\circ - 2(54^\circ) = 72^\circ$ (Isosceles triangle <i>DOE</i> )                                                                                                                                            | B1                                                      |
| 6(a)(ii)  | $\angle DBE = \frac{1}{2} \angle DOE = 36^\circ$ ( $\angle$ at center = 2 $\angle$ at circumference)                                                                                                                          | B1                                                      |
| 6(a)(iii) | $\angle OEF = 90^\circ$ (tangent perpendicular to radius)<br>$\angle DEF = 90^\circ - 54^\circ = 36^\circ$                                                                                                                    | B1                                                      |
| 6(a)(iv)  | $\angle BED = 180^\circ - 116^\circ = 64^\circ$ (angles in opposite segments)<br>$\angle OEB = 64^\circ - 54^\circ = 10^\circ$                                                                                                | B1                                                      |

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                          |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 6(a)(v)   | $\angle BAE = \angle BAD + \angle DAE$<br>$\angle DAE = 36^\circ$ ( $\angle$ s in same segment)<br>$\angle BAD = 180^\circ - 116^\circ$<br>$= 64^\circ$<br>$\angle BAE = 36^\circ + 64^\circ$<br>$= 100^\circ$<br><i>Alternatively</i><br>$\angle BED = 54^\circ + 10^\circ = 64^\circ$<br>$\angle BDE = 180^\circ - 64^\circ - 36^\circ = 80^\circ$ (angle sum of triangle)<br>$\angle BAE = 180^\circ - 80^\circ = 100^\circ$ (angles in opposite segments) | M1<br>A1<br><br>M1<br>A1 |
| 6(b)(i)   | $(r + 24)^2 = r^2 + 36^2$<br>$r^2 + 48r + 576 = r^2 + 1296$<br>$48r = 720$<br>$r = 15$                                                                                                                                                                                                                                                                                                                                                                        | M1<br><br>A1             |
| 6(b)(ii)  | Area<br>$= 2 \left( \frac{1}{2} \times 36 \times 15 \right)$<br>$= 540 \text{ cm}^2$                                                                                                                                                                                                                                                                                                                                                                          | M1<br><br>A1             |
| 7(a)(i)   | -123                                                                                                                                                                                                                                                                                                                                                                                                                                                          | B1                       |
| 7(a)(ii)  | 50                                                                                                                                                                                                                                                                                                                                                                                                                                                            | B1                       |
| 7(a)(iii) | 125                                                                                                                                                                                                                                                                                                                                                                                                                                                           | B1                       |
| 7(b)      | $x = 5n - 148$<br>$y = 2n^2$<br>$z = n^3$                                                                                                                                                                                                                                                                                                                                                                                                                     | B1<br>B1<br>B1           |
| 7(c)      | $2m^2 > 900$<br>$m^2 > 450$<br>$m = 22$                                                                                                                                                                                                                                                                                                                                                                                                                       | <br><br>B1               |
| 7(d)      | $5k - 48 > 0$<br>$5k > 48$<br>$k > 29.6$<br>$k = 30$                                                                                                                                                                                                                                                                                                                                                                                                          | <br><br><br>B1           |
| 7(e)      | The numbers in column 3 are cubic numbers. 1727 is not.                                                                                                                                                                                                                                                                                                                                                                                                       | B1                       |
| 8(a)      | $\frac{60}{x}$ parts                                                                                                                                                                                                                                                                                                                                                                                                                                          | B1                       |
| 8(b)      | $\frac{60}{x - \frac{1}{2}} = \frac{120}{2x - 1}$ (Accept $\frac{60}{x - \frac{1}{2}}$ )                                                                                                                                                                                                                                                                                                                                                                      | B1                       |

|      |                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                         |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8(c) | $\frac{60}{x} + \frac{120}{2x-1} = 56$ $60(2x-1) + 120x = 56x(2x-1)$ $120x - 60 + 120x = 112x^2 - 56x$ $112x^2 - 296x + 60 = 0$ $28x^2 - 74x + 15 = 0 \text{ (Shown)}$                                                                                                                                                                                                                                                 | M1: Forms Equation<br>M1: Manipulates equation to remove denominators<br>A1                                                                             |
| 8(d) | $x = \frac{-(-74) \pm \sqrt{(-74)^2 - 4(28)(15)}}{2(28)}$ $x = \frac{74 \pm \sqrt{3796}}{56}$ $x = 2.4216 \quad \text{or} \quad x = 0.2212$ $x = 2.42 \quad \text{or} \quad x = 0.22$                                                                                                                                                                                                                                  | For $\frac{p \pm \sqrt{q}}{r}$<br>B1: $q=74$ or $\sqrt{q} = 8.60\dots$<br>B1: $p=3796$ , $q = 56$<br>B1+B1<br>$x = 2.42 \quad \text{or} \quad x = 0.22$ |
| 8(e) | $300 \times 2.4216$ $= 726.48 \text{ min}$ $= 12 \text{ h } 6.48 \text{ min}$ $= 12 \text{ h } 6 \text{ min } 28.8 \text{ sec}$                                                                                                                                                                                                                                                                                        | M1 (12 hours)<br>A1                                                                                                                                     |
| 9    | Total Sv at source = $4(2.1 \times 10^4) = 8.4 \times 10^4$<br>Amount of radiation at 25 km<br>$= \frac{5 \times 10^{-2} \times 8.4 \times 10^4}{25^2}$ $= 6.72$ The safety radius is too small, the expert is right.<br>Let appropriate radius be $r$ ,<br>$5 = \frac{5 \times 10^{-2} \times 8.4 \times 10^4}{r^2}$ $r = \sqrt{\frac{5 \times 10^{-2} \times 8.4 \times 10^4}{5}}$ $r^2 = 840$ $r = 28.982$ $r = 29$ | M1<br>M1<br>M1                                                                                                                                          |

$$29 - 25 = 4 \text{ km}$$

The radius should be increased by at least 4 km.

A1

Name \_\_\_\_\_

Topic \_\_\_\_\_

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Date \_\_\_\_\_

