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Class	Register Number	Name
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南洋女子中學校
NANYANG GIRLS' HIGH SCHOOL

End-of-Year Examination 2015
Secondary One

INTEGRATED MATHEMATICS

1 hour 15 minutes

Paper 1

Monday

12 October 2015

0845 - 1000

READ THESE INSTRUCTIONS FIRST

INSTRUCTIONS TO CANDIDATES

1. Write your name, register number and class in the spaces at the top of this page.
2. Answer all the questions.
3. Write your answers and working in the spaces provided on the question paper.
4. **All working must be written in dark blue or black ink.**
5. **Omission of essential working will result in loss of marks.**
6. Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
7. The use of calculators is **NOT** allowed for this paper.

INFORMATION FOR CANDIDATES

1. The number of marks is given in brackets [] at the end of each question or part question.
2. The total number of marks for this paper is 50.
3. You are reminded of the need for clear presentation in your answers.

Setter: GT/CP

This document consists of 10 printed pages.
NANYANG GIRLS' HIGH SCHOOL

[Turn over

137

1. Arrange the following in ascending order:

$$0.\dot{2}\dot{1} \quad , \quad \frac{1}{5} \quad , \quad \frac{21}{100} \quad , \quad -0.21 \quad , \quad -0.2\dot{1}$$

Answer: _____ [2]

2. Alex reads $\frac{3}{5}$ of a book on Monday and $\frac{1}{3}$ of the remaining pages on Tuesday.

If he has 64 pages left to read after Tuesday, how many pages does the book have ?

Answer: _____ pages [2]

3. Evaluate the following:

(a) $2 - 3[5 - (-8)] \times 7 - (6 + 4)$

(b) $-\frac{5}{2} + 2\left(-\frac{1}{4}\right)^2 + \frac{2}{3} \div \left(-\frac{14}{9}\right)$

Answer: (a) _____ [2]

(b) _____ [2]

4. Even numbers are arranged in a table comprising three columns C1 to C3 for the 1st to 4th rows as shown below:

	C1	C2	C3
1 st row	2	4	6
2 nd row	8	10	12
3 rd row	14	16	18
4 th row	20	22	24
5 th row	a	...	...
...	...	...	...
n^{th} row	...	k	...
...	...	...	...
100 th row	...	...	x

- (a) Write down the value of a .
- (b) The number k is in the n^{th} row of column C2. Write down and simplify an equation connecting n and k .
- (c) The number x is in the 100th row of column C3. Calculate the value of x .

Answer: (a) $a =$ _____ [1]

(b) _____ [2]

(c) $x =$ _____ [1]

5. (a) Express 48 as the product of its prime factors.
- (b) What is the smallest natural number, n , for which $48n$ is a multiple of 315?
- (c) Find the smallest value of m such that the product $48m$ is a perfect cube.
- (d) Using your result in (c), evaluate $\sqrt[3]{48m}$.

Answer: (a) $48 =$ _____ [1]

(b) $n =$ _____ [2]

(c) $m =$ _____ [2]

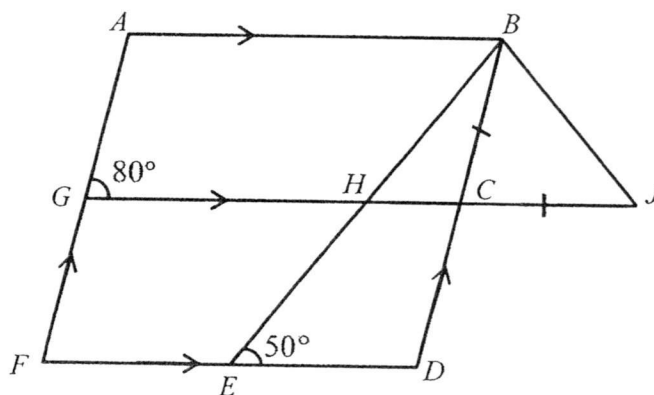
(d) _____ [1]

6. (a) Estimate the value of $\frac{5.112 \times 39.998}{0.199}$ correct to 1 significant figure.
Show all workings clearly.
- (b) Use your result in (a) to estimate the value of $\frac{0.5112 \times 0.39998}{1.99}$.
- (c) Using as much of the information below as necessary, evaluate $\sqrt{0.00486}$.
[$\sqrt{48.6} = 6.97$, $\sqrt{4.86} = 2.20$]

Answer: (a) _____ [2]
(b) _____ [2]
(c) _____ [2]

7. In the diagram, $ABDF$ is a parallelogram. GJ is a straight line parallel to AB and FD that cuts DB at C . BE is a straight line that cuts GJ at H . $\triangle BCJ$ is an isosceles triangle with $BC = JC$. $\angle AGH = 80^\circ$ and $\angle BED = 50^\circ$. Calculate the following angles, stating your reasons clearly.

- (a) $\angle BDE$
 (b) $\angle BHG$
 (c) $\angle BJC$



- Answer: (a) $\angle BDE =$ _____ [2]
 (b) $\angle BHG =$ _____ [2]
 (c) $\angle BJC =$ _____ [2]

8. Expand and simplify each of the following expressions:

(a) $(2x + 3y)^2$

(b) $2r[1 - 3s - 2(r - s + 1) - r]$

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

Answer: (a) _____ [1]

(b) _____ [2]

(c) _____ [3]

9. Factorise the following completely:

(a) $12u^2 + 9u - 3$

(b) $16x^2 - 25$

(c) $3ac + ad - 6bc - 2bd$

Answer: (a) _____ [2]

(b) _____ [2]

(c) _____ [3]

10. (a) Simplify the following, giving your answer as a single fraction in its simplest form:

$$3 - \frac{2(x-2)}{3} + \frac{x}{4}$$

(b) Solve $\frac{3}{x-4} = -\frac{2}{1+2x}$.

- (c) A company has x male employees and y female employees. The average yearly income of 1 employee is \$30 000. If the average yearly income of 1 female employee is $\$(x - 5000)$, write down an algebraic expression in a single fraction that represents the average yearly income of 1 male employee.

Answer: (a) _____ [3]

(b) $x =$ _____ [2]

(c) _____ [3]

- End of Paper -

No.	Solution
1	$-0.\dot{2}\dot{1}, -0.21, \frac{1}{5}, \frac{21}{100}, 0.\dot{2}\dot{1}$
2	$\frac{1}{3}$ of the remaining $\frac{2}{5}$ of the book = $\frac{2}{15}$ By Tuesday, he has read $\frac{3}{5} + \frac{2}{15} = \frac{11}{15}$ of the book. 64 pages represents $\frac{4}{15}$ of the book. No. of pages the book has = $64 \div 4 \times 15 = 240$
3a	$2 - 3[5 - (-8)] \times 7 - (6 + 4)$ $= 2 - 3(13) \times 7 - 10$ $= 2 - 273 - 10$ $= -281$
3b	$-\frac{5}{2} + 2\left(-\frac{1}{4}\right)^2 + \frac{2}{3} \div \left(-\frac{14}{9}\right)$ $= -\frac{5}{2} + 2\left(\frac{1}{16}\right) + \frac{2}{3} \times \left(-\frac{9}{14}\right)$ $= -\frac{19}{8} - \frac{3}{7}$ $= -\frac{157}{56}$ $= -2\frac{45}{56}$
4a	$a = 26$
4b	$k = 4 + 6(n - 1)$ $= 6n - 2$
4c	$x = 6 + 6(100 - 1)$ $= 600$ Or $x = 100 \times 6 = 600$
5a	$48 = 2^4 \times 3$
5b	$315 = 3^2 \times 5 \times 7$ $n = 3 \times 5 \times 7 = 105$
5c	$m = 2^2 \times 3^2 = 36$

5d	$\sqrt[3]{48m} = \sqrt[3]{2^4 \times 3 \times 2^2 \times 3^2}$ $= \sqrt[3]{2^6 \times 3^3}$ $= 2^2 \times 3$ $= 12$
6a	$\frac{5.112 \times 39.998}{0.199} \approx \frac{5.1 \times 40}{0.2}$ $= 1000$
6b	$\frac{0.5112 \times 0.39998}{1.99}$ $= \frac{5.112 \div 10 \times 39.998 \div 100}{0.199 \times 10}$ ≈ 0.1
6c	$\sqrt{0.00486} = \sqrt{48.6 \div 10000}$ $= 6.97 \div 100$ $= 0.0697$
7a	$\angle GCB = 180^\circ - 80^\circ$ (int. $\angle$, $GA \parallel CB$) $= 100^\circ$ $\angle BDE = 100^\circ$ (corres. $\angle$, $GJ \parallel FD$)
7b	$\angle EHC = 180^\circ - 50^\circ$ (supp. $\angle$) $= 130^\circ$ $\angle BHG = 130^\circ$ (vert. opp. $\angle$)
7c	$\angle BCG = \angle BDE = 100^\circ$ (corres. $\angle$, $GJ \parallel FD$) $\angle BJC = 100^\circ \div 2$ (ext. $\angle$ = sum of opp. int. $\angle$) $= 50^\circ$
8a	$(2x + 3y)^2$ $= 4x^2 + 12xy + 9y^2$
8b	$2r\{1 - 3s - 2(r - s + 1) - r\}$ $= 2r\{1 - 3s - 2r + 2s - 2 - r\}$ $= 2r\{-1 - s - 3r\}$ $= -2r - 2rs - 6r^2$
8c	$3(2x - y)(x + y) - (x + 2y)(x - 2y)$ $= 3(2x^2 + 2xy - xy - y^2) - (x^2 - 4y^2)$ $= 3(2x^2 + xy - y^2) - x^2 + 4y^2$ $= 6x^2 + 3xy - 3y^2 - x^2 + 4y^2$ $= 5x^2 + 3xy + y^2$

9a	$12u^2 + 9u - 3$ $= 3(4u^2 + 3u - 1)$ $= 3(4u - 1)(u + 1)$ OR $12u^2 + 9u - 3$ $= (4u - 1)(3u + 3)$ $= 3(4u - 1)(u + 1)$
9b	$16x^2 - 25$ $= (4x)^2 - 5^2$ $= (4x - 5)(4x + 5)$
9c	$3ac + ad - 6bc - 2bd$ $= a(3c + d) - 2b(3c + d)$ $= (a - 2b)(3c + d)$
10a	$3 - \frac{2(x-2)}{3} + \frac{x}{4}$ $= \frac{36 - 8(x-2) + 3x}{12}$ $= \frac{36 - 8x + 16 + 3x}{12}$ $= \frac{52 - 5x}{12}$
10b	$\frac{3}{x-4} = -\frac{2}{1+2x}$ $3(2x+1) = -2(x-4)$ $6x+3 = -2x+8$ $8x = 5$ $x = \frac{5}{8}$

10c)

Total yearly income of all the staff in \$ = $30000(x + y)$

Total yearly income of female employees in \$
 $= y(x - 5000)$

Total yearly income of male employees in \$
 $= 30000(x + y) - y(x - 5000)$
 $= 30000x + 30000y - xy + 5000y$
 $= 30000x - xy + 35000y$

Average yearly income of male employees in \$
 $= \frac{30000x - xy + 35000y}{x}$

Class	Register Number	Name
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南洋女子中学校
NANYANG GIRLS' HIGH SCHOOL

End-of-Year Examination 2015
Secondary One

INTEGRATED MATHEMATICS

1 hour 15 min

Paper 2

Thursday

8 Oct 2015

1030 – 1145 hrs

READ THESE INSTRUCTIONS FIRST

INSTRUCTIONS TO CANDIDATES

1. Write your name, register number and class in the spaces at the top of this page.
2. Answer all the questions from number 1 to 10 before attempting the Bonus Question number 11.
3. Write your answers and working on the separate writing paper provided.
4. **All working must be written in dark blue or black ink.**
5. **Omission of essential working will result in loss of marks.**
6. Write your name, register number and class on each separate sheet of paper that you use and fasten the separate sheets together with the string provided. Do not staple your answer sheets together.
7. Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
8. The use of calculators is allowed for this paper.

INFORMATION FOR CANDIDATES

1. The number of marks is given in brackets [] at the end of each question or part question.
2. The total number of marks for this paper is 50.
3. You are reminded of the need for clear presentation in your answers.

Parent's Signature: _____

Score: _____

_____/50

Setter: CP and GT

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NANYANG GIRLS' HIGH SCHOOL

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1. Answer the whole of this question on the piece of plain paper provided.

Using only a ruler and a pair of compasses, construct

- (a) $\triangle ABC$ such that $AB = 12$ cm, $BC = 8$ cm and $AC = 10$ cm, [1]
- (b) the angle bisector of $\angle BAC$, [1]
- (c) the perpendicular bisector of BC . [1]
- (d) a circle which passes through the vertices A, B and C . [2]

2. A building has a perimeter of 8 cm, with a gate of width 0.5 cm on a map. If the actual perimeter of the building is 0.56 km,

- (a) find the scale of the map in the form $1 : r$. [1]

A model of the building is made to another scale of $1 : 5000$. Calculate

- (b) (i) the width of the gate in centimetres as represented by the second scale, [1]
- (ii) the floor area of the building model in square centimetres if the actual floor area of the building is $16\,000\text{ m}^2$. [2]

3. In 2008, the price of a car was \$45 000. In 2015, the price of the same car is \$85 000.

- (a) Calculate the percentage increase in the price of the car, leaving your answer to 1 decimal place. [2]
- (b) In 2015, the dealer decides to cut down the price of the car by 5%. Calculate the new price of the car. [2]

- 4. (a)** In the Lifeskills Camp, 6 litres of milo is given to a class of 30 students as supper. Find the additional volume of milo needed for a class of 35 if each student is to get the same amount of milo. [2]
- (b)** A small tap can fill up a tank with water in 5 hours. A big tap can fill up the same tank in 3 hours. If both taps were switched on at the same time, how long would it take to fill up 2 of such tanks? [2]

5. In an octagon, four of the interior angles are $2x^\circ$ each and the other four angles are $(2x+15)^\circ$, $(2x+25)^\circ$, $(2x+35)^\circ$ and $(3x-15)^\circ$ respectively. Find
- (a) the value of x , [3]
- (b) the size of the smallest exterior angle. [2]
6. Given that $x^2 + y^2 = 26$ and $xy = (-5)$, evaluate
- (a) $\left(\frac{x-y}{2}\right)^2$, [2]
- (b) $(x+y)^4$. [2]
7. Simplify $\sqrt{\frac{16x^4y^2}{25z^4}} \div \frac{12x+12y}{2x^2z^3} \times \left(\frac{3(x+y)}{-2xz}\right)^3$, giving your answer as a single fraction in its simplest form. [4]
8. Ann's car can travel x km on each litre of petrol. She travelled $(x+10)$ km on Monday.
- (a) Write down, in terms of x , the number of litres of petrol she used on Monday. [1]
- (b) Given that she travelled $(2x+15)$ km on Tuesday and used 1.25 litres of petrol more on Tuesday than on Monday, form an equation in x and solve it. [3]
- (c) Calculate the total distance that she travelled on Monday and Tuesday. [1]

9.

Number of books borrowed	0	1	2	3	4	5
Number of students	7	x	6	2	4	5

The table above shows the number of books borrowed by the students of a class.

- (a) If the mean is 2.25, form an equation in x and use it to find the value of x . [3]
- (b) Find the largest possible value of x if the median number of books borrowed is 2. [2]

10. In this question, take $\pi = 3.142$ and leave all your answers to 2 decimal places.

[Volume of a cone with height h and base radius r is $\frac{1}{3}\pi r^2 h$,

Curved surface area of cone with slant height l and base radius r is $\pi r l$.]

[Volume and surface area of a sphere with radius r are $\frac{4}{3}\pi r^3$ and $4\pi r^2$ respectively.]

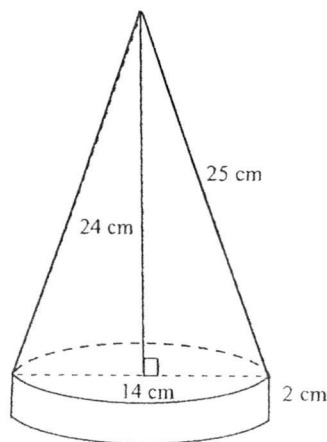


Figure 1

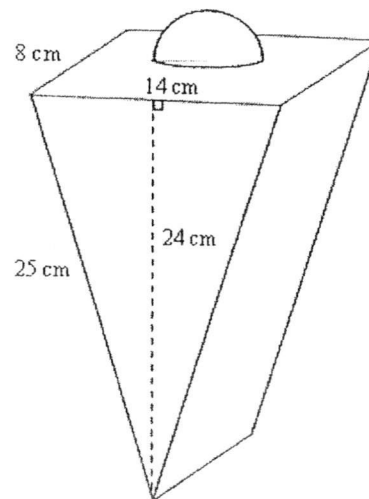


Figure 2

Figure 1 shows a solid object made up of a right cone with height 24 cm, and slant height 25 cm, and a cylinder with diameter 14 cm and height 2 cm. For the solid object in Figure 1, calculate

- (a) (i) the surface area, [2]
(ii) the volume. [2]

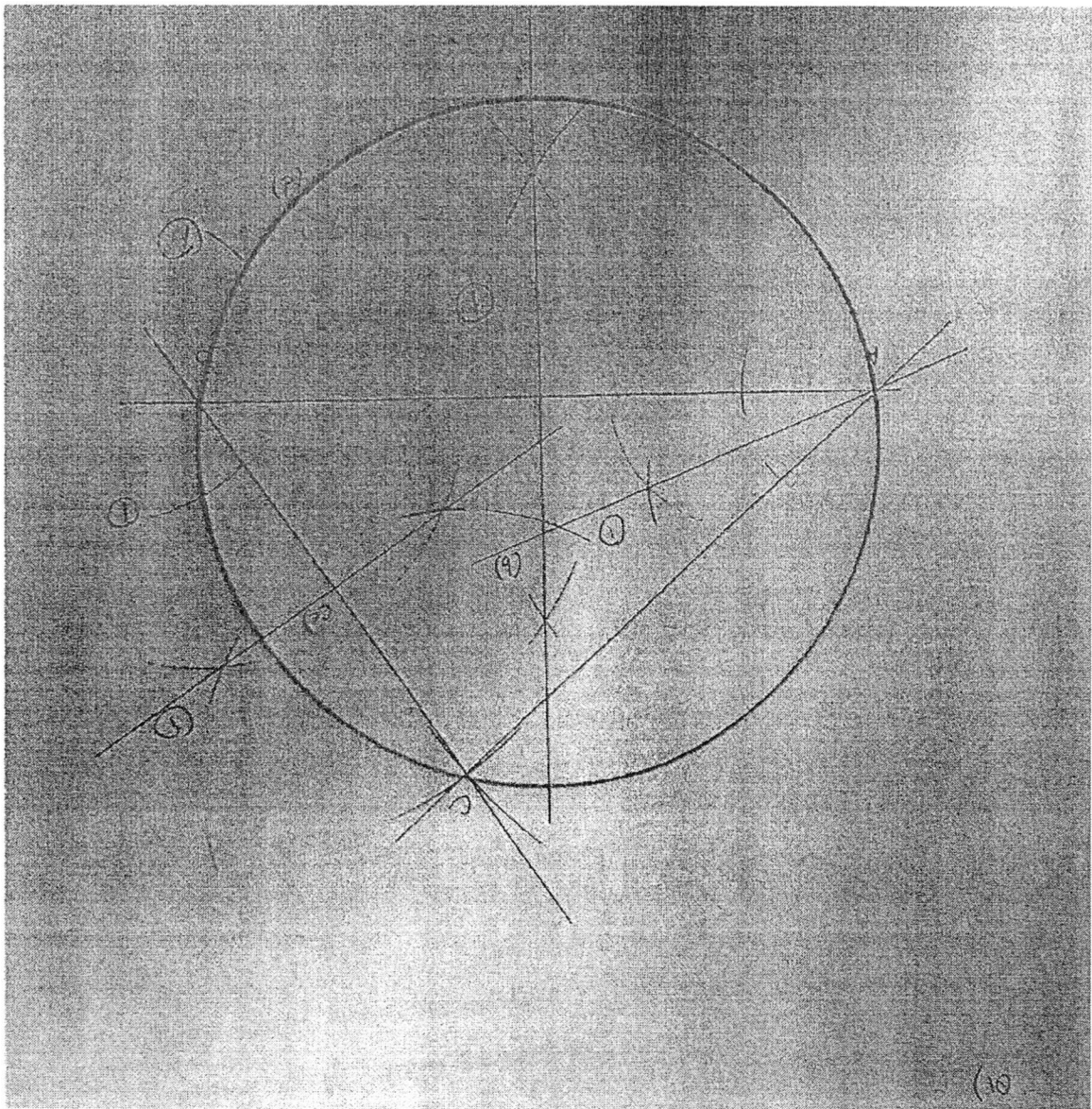
The object in Figure 1 is then melted down to form another solid object as shown in Figure 2. It is made up of a triangular prism and a hemisphere resting at the top of it. The triangular prism has thickness 8 cm and its triangular face has base 14 cm, perpendicular height 24 cm and slant height 25 cm. For the solid object in Figure 2, calculate

- (b) (i) the radius of the hemisphere, [3]
(ii) the total surface area. [3]

Bonus Question

11. Without the use of calculator, evaluate $\frac{1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{5} - \frac{1}{6} + \dots + \frac{1}{2005} - \frac{1}{2006}}{\frac{1}{1+2007} + \frac{1}{2+2008} + \dots + \frac{1}{1003+3009}}$. [3]

END OF PAPER



1	Construction on separate piece
2a	$0.56\text{km} = 56\,000\text{ cm}$ $56000 \div 8 = 7000$ Scale of map = 1 : 7000
2 bi	$0.5 \times 7000 \div 5000$ $= 0.7\text{ cm}$
2 bi i	Conversion $1\text{ cm}^2 = 0.0001\text{ m}^2$ On the scale model, 1 : 5000 $1\text{ cm}^2 : 25\,000\,000\text{ cm}^2$ Actual floor area of building $16\,000\text{ m}^2 = 160\,000\,000\text{ cm}^2$ Floor area of building model = $160\,000\,000 \div 25\,000\,000$ $= 6.4\text{ cm}^2$
3a	$\frac{85000 - 45000}{45000} \times 100$ $= 88.9\%$
3 b	0.95×85000 $= \$80750$
4a	Additional volume of milo $= \frac{35 - 30}{30} \times 6$ $= 1\text{ l}$
4 b	Small tap fills up $\frac{1}{5}$ of the tank in 1 hr Big tap fills up $\frac{1}{3}$ of the tank in 1 hr With both taps switched on, $\frac{1}{5} + \frac{1}{3} = \frac{8}{15}$ of the tank is filled up in 1 hr. Time taken to fill up 2 of such tanks $= \frac{15}{8} \times 2$ $= 3.75\text{ hrs}$

5a	Sum of interior angles of an octagon $= 180^\circ(8 - 2)$ $= 1080^\circ$ $1080^\circ = 4 \times 2x + 2x + 15^\circ + 2x + 25^\circ$ $1080^\circ = 17x + 60^\circ$ $17x = 1020^\circ$ $x = 60$
5 b	Smallest exterior angle = $180^\circ - [3 \times 60^\circ - 15^\circ]$ $= 15^\circ$
6a	$\left(\frac{x - y}{2}\right)^2$ $= \frac{x^2 - 2xy + y^2}{4}$ $= \frac{26 - 2(-5)}{4}$ $= \frac{26 + 10}{4}$ $= 9$
6 b	$(x + y)^4$ $= [(x + y)^2]^2$ $= (x^2 + 2xy + y^2)^2$ $= (26 + 2(-5))^2$ $= 16^2$ $= 256$
7	$\sqrt{\frac{16x^4y^2}{25z^4} \div \frac{12x + 12y}{2x^2z^3} \times \left(\frac{3(x + y)}{-2xz}\right)^3}$ $= \frac{4x^2y}{5z^2} \times \frac{2x^2z^3}{12(x + y)} \times \frac{27(x + y)^3}{-8x^3z^3}$ $= \frac{-9xy(x + y)^2}{20z^2}$

8a i	$\frac{x+10}{x}$ litres
b	$\frac{x+10}{x} + 1.25 = \frac{2x+15}{x}$ $\frac{x+10+1.25x}{x} = \frac{2x+15}{x}$ $2.25x+10 = 2x+15$ $0.25x = 5$ $x = 20$
c	Total dist travelled = $20+10+2(20)+15$ = 85 km
9a	$2.25(7+x+6+2+4+5) = x+12+6+16+25$ $2.25(24+x) = x+59$ $54+2.25x = x+59$ $1.25x = 5$ $x = 4$
b	$7+x = 5+2+4+5$ $x = 9$
10 ai	Total surface area = surface area of cone + surface area of cylinder + base area Total surface area = $3.142 \times 7 \times 25 + 3.142 \times 14 \times 2 +$ $3.142 \times 7 \times 7$ $= 549.85 + 87.976 + 153.958$ $= 791.78 \text{ cm}^2$
10 aaii	Total vol = vol of cone + vol of cylinder Total Volume $= \frac{1}{3} \times 3.142 \times 7 \times 7 \times 24 +$ $3.14 \times 7 \times 7 \times 2$ $= 1231.664 + 307.916$ $= 1539.58 \text{ cm}^3$

10bi)

Vol of hemisphere + vol of prism = total vol
from (ai)

Let the radius of the hemisphere be r

$$\left(\frac{1}{2}\right)\left(\frac{4}{3}\right)(3.142)r^3 + \left(\frac{1}{2}\right)(14)(24)(8) = 1539.58$$

$$\left(\frac{2}{3}\right)(3.142)r^3 + 1344 = 1539.58$$

$$\left(\frac{2}{3}\right)(3.142)r^3 = 195.58$$

$$r^3 = 93.37046$$

$$r = 4.54 \text{ (to 3 sf)}$$

10bii)

Surface area of hemisphere

$$= \left(\frac{1}{2}\right)(4)(3.142)(4.54)^2$$

$$= 129.52 \text{ cm}^2$$

Surface area of top of pyramid

without the area covered by hemisphere

$$= (14 \times 8) - (3.142)(4.54)^2$$

$$= 112 - 64.762$$

$$= 47.238 \text{ cm}^2$$

Surface area of the triangular faces

$$= \left(\frac{1}{2}\right)(14)(24)(2) + (2)(8)(25)$$

$$= 336 + 400$$

$$= 736 \text{ cm}^2$$

Total surface area

$$= 736 + 47.238 + 129.52$$

$$= 912.76 \text{ cm}^2 \text{ (to 2 dp)}$$

2015 Sec 1 EOY Paper 2 Solutions

$$\begin{aligned}
 11. & \frac{1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{5} - \frac{1}{6} + \dots + \frac{1}{2005} - \frac{1}{2006}}{\frac{1}{1+2007} + \frac{1}{2+2008} + \dots + \frac{1}{1003+3009}} \\
 &= \frac{1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} + \dots + \frac{1}{2005} + \frac{1}{2006} - \left(\frac{1}{2} + \frac{1}{4} + \frac{1}{2006} \right) \times 2}{\frac{1}{2008} + \frac{1}{2010} + \dots + \frac{1}{4012}} \\
 &= \frac{1 + \frac{1}{2} + \dots + \frac{1}{2005} + \frac{1}{2006} - \left(1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{1003} \right)}{\frac{1}{2} \times \left(\frac{1}{1004} + \frac{1}{1005} + \dots + \frac{1}{2006} \right)} \\
 &= \frac{\frac{1}{1004} + \frac{1}{1005} + \dots + \frac{1}{2006}}{\frac{1}{2} \times \left(\frac{1}{1004} + \frac{1}{1005} + \dots + \frac{1}{2006} \right)} \\
 &= 2
 \end{aligned}$$