Class	Index Number	Name

ANG MO KIO SECONDARY SCHOOL
MID-YEAR EXAMINATION 2016
SECONDARY THREE EXPRESS

MATHEMATICS **4048/01**
Paper 1

Monday **09 May 2016** **2 hours**

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams or graphs.
Do not use highlighters, glue or correction fluid.

Answer **all** questions.
If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
Calculators should be used where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is **80**.

For Examiner's Use
80

This document consists of **16** printed pages

Mathematical Formulae

Compound interest

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

Mensuration

Curve surface area of a cone = πrl

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

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

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

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

Arc length = $r\theta$, where θ is in radians

$$\text{Sector Area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

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

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

1 **(a)** Calculate $\dfrac{\sqrt[3]{0.1257}-0.258^2}{1.5^{3.41}}$.

Write down the first six digits on your calculator display.

Answer (a) _____ [1]

(b) Write your answer to part **(a)** correct to 4 significant figures.

Answer (b) _____ [1]

---

2 Factorise completely $12x^2y^2-1-3x^2+4y^2$.

Answer _____ [2]

---

3 Cider costs p cents per litre.

Given that a barrel can contain q cm^3 of cider, find an expression, in terms of p and q, for the cost of a barrel of cider in dollars.

Answer $ _____ [3]

---

4 **(a)** Given that $25^{15} \div 125 = 5^k$, find k.

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

(b) Simplify

(i) $\dfrac{x^0}{y^2} \div \dfrac{3}{y^3}$,

Answer (b)(i) _____ [2]

(ii) $2 \div \dfrac{6}{5x^{-3}}$.

Answer (b)(ii) _____ [2]

(c) Simplify $\sqrt[6]{x^7} + \dfrac{\sqrt{x^5}}{\sqrt[3]{x^4}}$, leaving your answer in radical form.

Answer (c) _____ [3]

5 Simplify $\dfrac{2}{(1-2x)^2} - \dfrac{3}{2x-1}$.

Answer _____ [2]

---

6 Written as the product of their prime factors,

$$a = 2^2 \times 5 \times 7,$$
$$b = 2 \times 3 \times 5^3,$$
$$c = 2^2 \times 3^2 \times 5^2.$$

Find

(a) the value of the square root of c,

Answer (a) _____ [1]

(b) the LCM of a, b and c, giving your answer as the product of its prime factors,

Answer (b) _____ [1]

(c) the greatest number that will divide a, b and c exactly.

Answer (c) _____ [1]

---

7 The scale of a map is 2.5 cm : 0.5 km.

(a) Write this scale in the form 1 : n.

Answer (a) _____ [1]

(b) The distance between two villages on the map is 12.5 cm.

Find the actual distance, in kilometres, between the two villages.

Answer (b) _____ km [1]

(c) A reservoir has an actual area of 7.5 km^2.

Find the area, in square centimetres, of the reservoir on the map.

Answer (c) _____ cm^2 [2]

---

8 **(a)** Express $x^2 - 12x + 9$ in the form $(x + a)^2 + b$.

Answer (a) _____ [1]

(b) **Hence** solve the equation $x^2 - 12x + 9 = 0$, giving your answers correct to two decimal places.

Answer (b) $x =$ _____ or _____ [3]

---

9 Solve the simultaneous equations

$$5x + 6y = 9,$$

$$7y + 8x = 17.$$

Answer $x =$ .....

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

10 **(a)** Solve the inequality $x-2<2x+7\leq\frac{3x+8}{3}$.

Answer (a) _____ [3]

(b) **Hence** write down the smallest integer value of x which satisfies $x-2<2x+7\leq\frac{3x+8}{3}$.

Answer (b) _____ [1]

---

11 Operating on their own, pipe A and pipe B can fill a tanker with petrol in 5 minutes and 7 minutes respectively.

Find the time taken for the tanker to be filled by the two pipes operating together.

Answer _____ mins _____ s [3]

---

12 In a survey, a group of students were asked how many siblings they have.The number is shown in the table below.

Number of siblings	0	1	2	3	4
Number of students	24	28	$2x-3$	7	3

(a) Write down the largest possible value of x if the modal number of siblings is 1.

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

(b) Write down the smallest possible value of x if the median number of siblings is 2.

Answer (b) $x =$ _____ [1]

(c) Calculate the value of x if the mean number of siblings is 1.

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

---

13 Solve the equation $\frac{3x-4}{3}+\frac{4}{7}=\frac{x-5}{5}$.

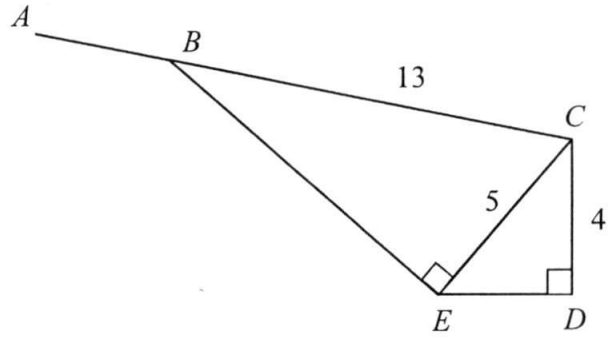
Answer $x =$ _____ [2]

---

14 Angle $BEC = 90°$ and angle $CDE = 90°$.

CB is produced to A.

$CE = 5$ cm, $BC = 13$ cm and $DE = 3$ cm.



Write down

(a) $\sin \angle DEC$,

Answer (a) $\sin \angle DEC =$ _____ [1]

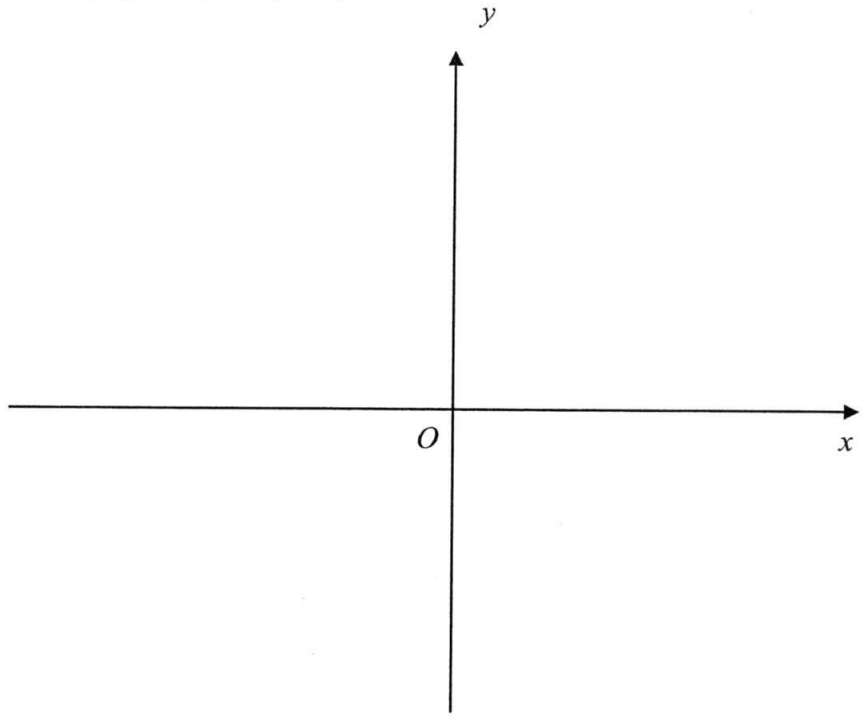
(b) $\tan \angle BCE$,

Answer (b) $\tan \angle BCE =$ _____ [2]

(c) $\cos \angle ABE$.

Answer (c) $\cos \angle ABE =$ _____ [1]

15 **(a)** **(i)** Sketch the graph of $y = x(6-x)$.

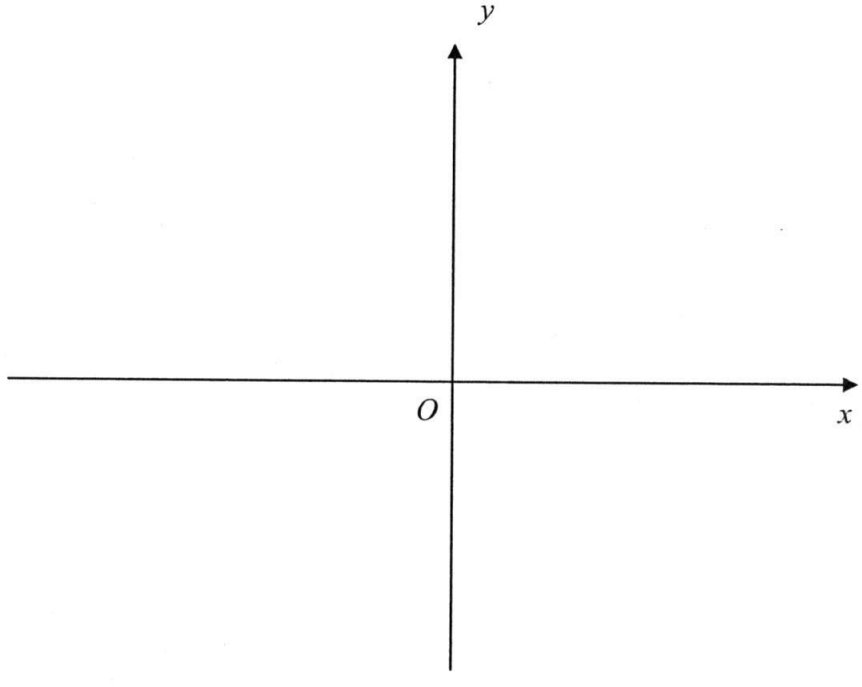


[2]

(ii) Write down the equation of the line of symmetry of $y = x(6-x)$.

Answer (a)(ii) _____ [1]

(b) **(i)** Sketch the graph of $y = 4 + (x-3)^2$.



[2]

(ii) Write down the coordinates of the minimum point of the curve.

Answer (b)(ii) (_____ , _____) [1]

16 According to studies, the Earth has witnessed five major mass extinctions.

(a) The first major mass extinction, the End Ordovician event and the last major mass extinction, the End Cretaceous event happened 0.44 billion and 66 million years ago respectively.

Find the number of years between the two events.

Give your answer in standard form.

Answer (a) _____ years [1]

(b) During the Cretaceous period, ammonite, a spherical organism of diameter 2.5 millimetres thrived in the ocean.

Calculate the volume of an ammonite in cubic centimetres.

Answer (b) _____ cm^3 [2]

(c) The Cretaceous period ended when an asteroid impacted the Earth.

Given that the asteroid travelled 8325 millimetres in an hour, calculate the speed of the asteroid.

Express your answer in kilometres per second.

Answer (c) _____ km/s [2]

17 A train departs from Moscow, Russia and arrives at Nice, France in 51 hours and 53 minutes.

When the local time in Moscow is 1.13 am, Wednesday, the local time in Nice is 11.13 pm, Tuesday.

(a) The train left Moscow at 10.13 pm, Monday local time.

What was the local time and day in Nice when it arrived?

Answer (a) _____ , _____ [2]

(b) The train travelled a total distance of 3281 km.

Find the average speed, in kilometres per hour, of the train.

Answer (b) _____ km/h [2]

---

18 The surface tension of a water droplet, B units, is directly proportional to the square of its radius, r cm.

The surface tension is 1 unit when the radius of the water droplet is R cm.

Find the percentage increase in the surface tension of the water droplet when the radius is $4R$ cm.

Answer _____ % [3]

---

19 Paul has a bag of marbles. He divided the marbles into three boxes, A, B and C.
The total number of marbles in box A and B as compared to the marbles in box C is in the ratio of 7 : 5, and the total number of marbles in box B and C as compared to the marbles in box A is in the ratio of 13 : 8.
Given that there are 34 marbles in box B, find the total number of marbles in the bag.

Answer _____ marbles [3]

---

20 (a) Krystal bought a camera at a cost price of $1188 from the warehouse.
Given that she wants to make a 28% profit, calculate the selling price of the camera.

Answer (a) $ _____ [2]

(b) Krystal also had a meal at a restaurant which amounted to $129.90 after a service charge of 10 % and a Goods and Service Tax (GST) of 7%.
Calculate the cost price of the meal **exclusive** of the service charge and GST.

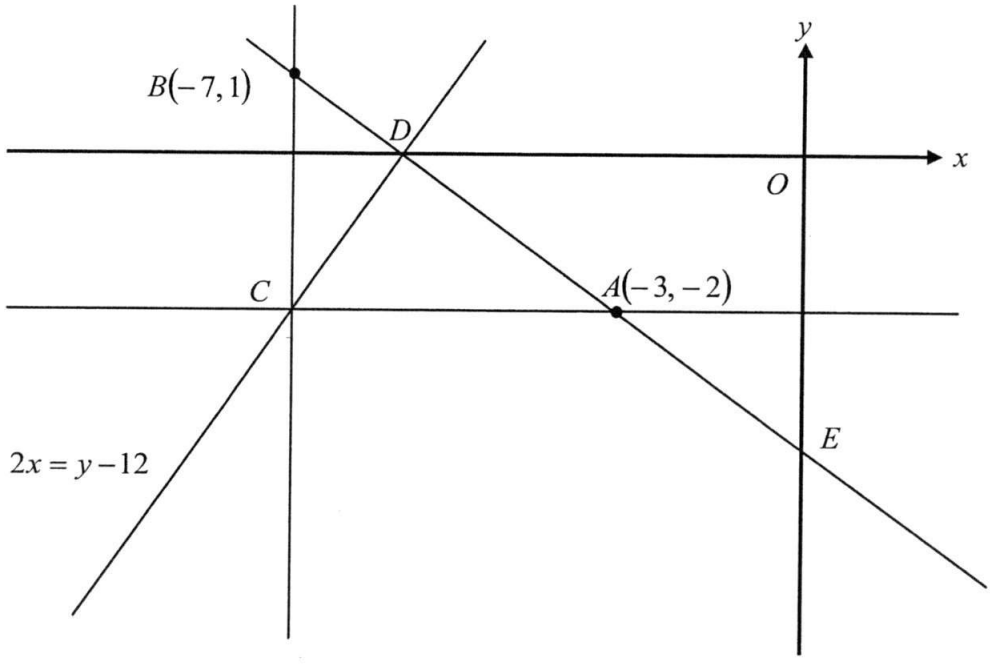
Answer (b) $ _____ [2]

---

21 The line CD has an equation $2x = y - 12$ and cuts the x-axis at D.

The line AD cuts the x-axis and y-axis at D and E respectively.

Given that the line AC is parallel to the x-axis and the line BC is parallel to the y-axis, find



(a) the coordinates of C,

Answer (a) (_____ , _____) [1]

(b) the equation of the line AC,

Answer (b) _____ [1]

(c) the coordinates of D,

Answer (c) (_____ , _____) [1]

21(d) is on the next page

(d) the length of the line AB,

Answer (d) _____ units [1]

(e) the equation of the line AB,

Answer (e) _____ [2]

(f) the coordinates of E.

Answer (f) (_____ , _____) [1]

END OF PAPER

Class	Index Number	Name

ANG MO KIO SECONDARY SCHOOL
MID-YEAR EXAMINATION 2016
SECONDARY THREE EXPRESS

MATHEMATICS **4048/02**
Paper 2

Friday **06 May 2016** **2 hours 30 minutes**

Additional Materials: Answer Paper

READ THESE INSTRUCTIONS FIRST

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

Answer **all** questions.
If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 100.

This document consists of **12** printed pages.

Mathematical Formulae

Compound interest

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

Mensuration

Curved surface area of a cone $= \pi rl$

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

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

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

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

Arc length $= r\theta$, where θ is in radians

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

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

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

Answer **all** the questions.

1 **(a)** Solve the equations

(i) $3x^2 - 507 = 0$, [2]

(ii) $\dfrac{x-2}{x+3} - \dfrac{x-3}{12+4x} = 5$. [3]

(b) The equation for calculating the focal length of a lens is given by

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}.$$

(i) Find the value of f when $u = 4\times10^{-2}$ and $v = 1.2\times10^{-1}$. [1]

(ii) Express v in terms of f and u. [2]

(c) Given that $\dfrac{8m+3n}{3n-2m} = \dfrac{3}{2}$, find the value of $\dfrac{m}{n}$. [2]

(d) Given that $x - 2y = 3$ and $x^2 + 4y^2 = 1$, find the value of xy. [2]

(e) At a games carnival, the prices of tickets for adults and children are \$2.40 and \$1.60 respectively.

The number of adult tickets and children tickets sold can be represented by a and c respectively.

(i) On a particular day, the total number of adult tickets sold is 30 less than the number of children tickets sold.

Write down an equation in a and c to represent this information. [1]

(ii) If on the same day the total sales of tickets amount to \$228, write down an equation in a and c to represent this information. [1]

(iii) Solve these two equations to find the number of adult and children tickets sold on that day. [3]

2 **(a)** Simplify the following expressions, leaving your answers in positive index where necessary.

(i) $\dfrac{1}{9c^{-2}} \times \dfrac{(3d)^{-1}}{c^3}$ [2]

(ii) $\dfrac{5f^2g^3}{21gh} \div \dfrac{40f^5g^2}{7h^3}$ [2]

(b) Given that x and y are integers such that $-7 \le x < 3$ and $-2 \le y \le 3$, calculate

(i) the greatest value of $x + y$, [1]

(ii) the least value of xy, [1]

(iii) the greatest value of $x^2 - y^2$. [1]

(c) Peter can make z waffles in 1 hour. In the same amount of time, Bruce is able to make 2 more waffles than Peter. On a particular day, both Peter and Bruce made not more than 126 waffles in the span of 2 hours and 15 minutes.

(i) Using the above information, form an inequality in z, and solve it. [2]

(ii) Hence, find the maximum number of waffles that Bruce can make in 1 hour. [1]

3 Penny works in a cheesecake cafe that pays her a wage of $\$x$ per hour.
In March, her salary was \$2000.

(a) Write down an expression in terms of x, for the number of hours she worked in March. [1]

(b) From April onwards, Penny's wage was increased by \$1.50 per hour. If she also received \$2000 in April, write down an expression in terms of x, for the number of hours she worked in April. [1]

(c) If Penny worked 13 hours less in April than in March, form an equation in x and show that it reduces to

$$26x^2 + 39x - 6000 = 0.$$ [3]

(d) Solve the equation $26x^2 + 39x - 6000 = 0$, giving both answers correct to two decimal places. [3]

(e) Calculate the minimum number of hours Penny needs to work in May if she aims to earn a salary of at least \$3000. [1]

---

4 **(a)** Leonard deposits \$7000 in a bank that gives a compound interest of 0.8% per annum.

Calculate the total amount of money Leonard will receive after 8 years. [2]

(b) Rajesh has \$7000. He decides to open a toy shop that will cost him \$30000. He borrows the remaining amount from a bank that charges him 2.5% simple interest per annum for 8 years.

Calculate the monthly installment that Rajesh needs to pay the bank. [3]

(c) Sheldon wants to invest €7000 in currency exchange. He decides to change his Euros (€) to Swedish Kroner (SKR). In June, he changes the money at a rate of €1 = 6.03 SKR. In July, the exchange rate changes to €1 = 5.71 SKR.

If Sheldon exchanges all his money back to Euros in July, calculate the profit that he earns in Euros. [2]

(d) Steward bought a motorcycle that cost \$7000.

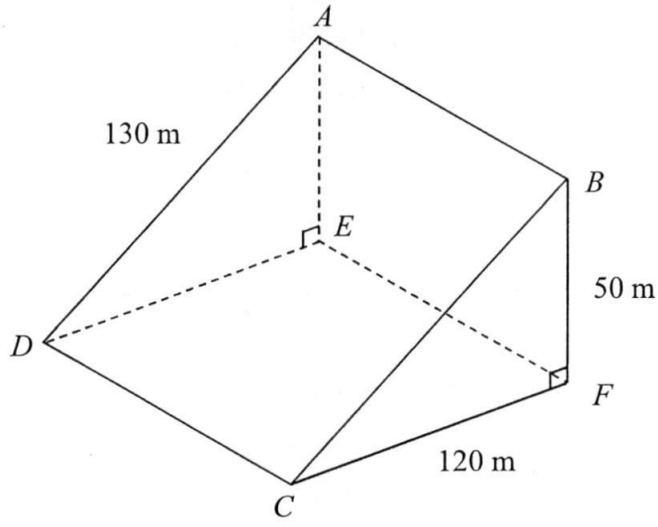
The value of the motorcycle depreciated by 12% during the first year.

In the second year, the motorcycle further depreciated by 20% of its new value.

If Steward sold off his motorcycle at the end of the second year, calculate the amount of money that he lost. [2]

---

5 **(a)** The diagram shows a model of the slope of a hill. $ABCD$ is a rectangle such that $AD = 130\,\text{m}$, and $CDEF$ is a square with sides 120 m. A and B are 50 m vertically above E and F respectively and $\angle AED = \angle BFC = 90°$.



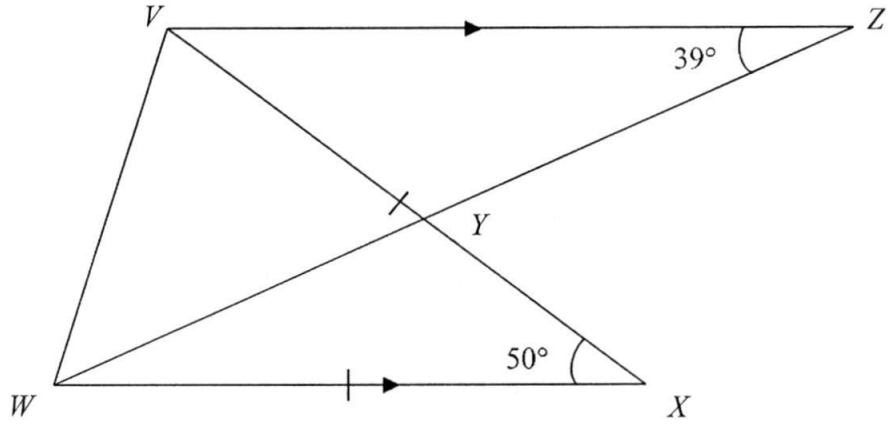
Find

(i) the length of CE, [2]

(ii) $\angle BDF$, [2]

(iii) $\angle DAF$. [3]

(b) In the diagram below, the lines WZ and VX intersect at Y. VWX is an isosceles triangle where $VX = WX$ and $\angle VXW = 50°$.



Given that VZ is parallel to WX and $\angle VZW = 39°$, find

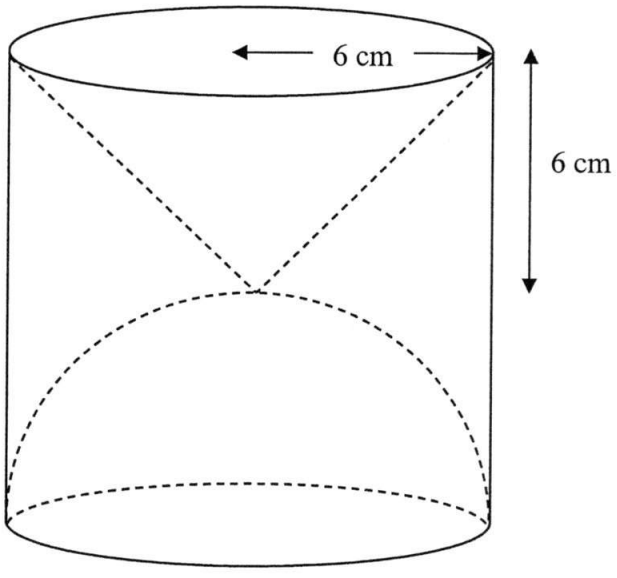
(i) $\angle ZYX$, [2]

(ii) $\angle VWZ$. [2]

6 The diagram shows a wooden cylinder that has removed parts in the shape of a hemisphere and a cone on opposite ends.

The radius of the base of the cylinder is 6 cm.

The perpendicular height of the cone is equal to the radius of its base.



(a) Find the height of the cylinder. [1]

(b) Calculate

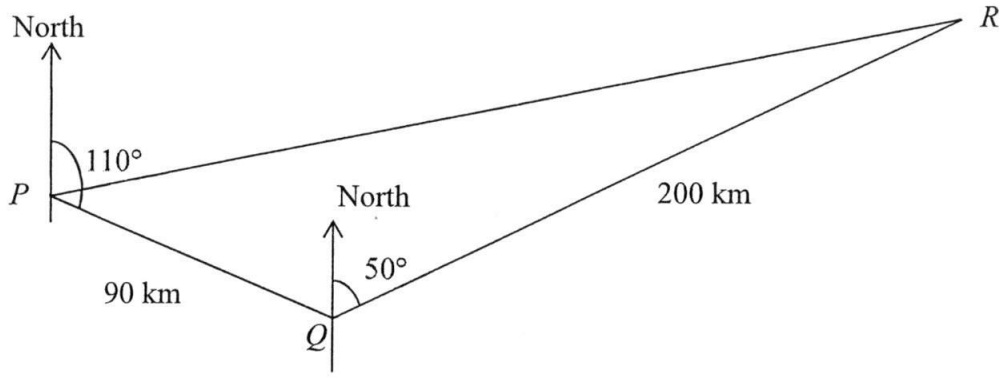
(i) the volume of the cone, [2]

(ii) the volume of the hemisphere, [2]

(iii) the volume of the solid. [2]

(c) Calculate the total surface area of the solid. [4]

7 The diagram shows three towns P, Q and R on a horizontal ground. Town Q is 200 km away from R and 90 km away from P. The bearing of town R from Q is 050° and the bearing of town Q from P is 110°.



(a) **(i)** Find $\angle PQR$. [1]

(ii) **Hence**, calculate the area of ΔPQR. [2]

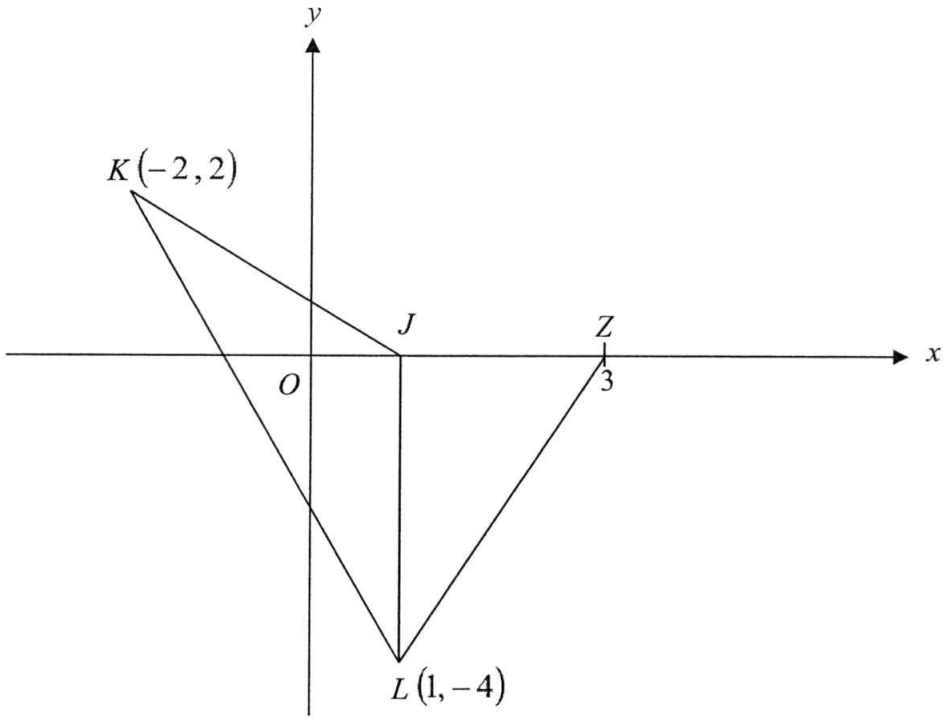
(b) Show that the distance between towns P and R is approximately 257 km. [3]

(c) Calculate the bearing of town P from town R. [3]

(d) An eagle was hovering 3 km vertically above town Q.
Calculate the greatest possible angle of depression of the eagle to a point along PR. [3]

8 JKL is a triangle where the line JL is parallel to the y-axis.

Point J lies on the x-axis, and the coordinates of L is $(1, -4)$ and K is $(-2, 2)$.



(a) **(i)** Calculate the area of ΔJKL. [1]

(ii) **Hence**, calculate the perpendicular distance from J to KL. [3]

(b) Write down the equation of line JL. [1]

(c) The line LZ meets the x-axis at $(3\ ,\ 0)$.

Given that coordinates of point X is $(6\ ,\ 6)$, prove that points L, X and Z lie on the same line. [2]

9 The figures below are formed by squares of lengths 1, 2, 3, … units. The table shows the corresponding lengths (L) and perimeter (P) of each figure (n).

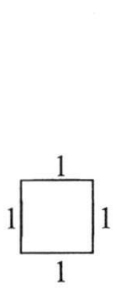


Figure 1

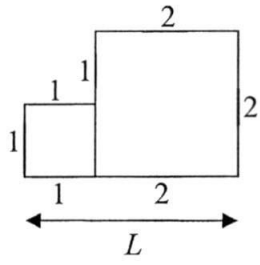


Figure 2

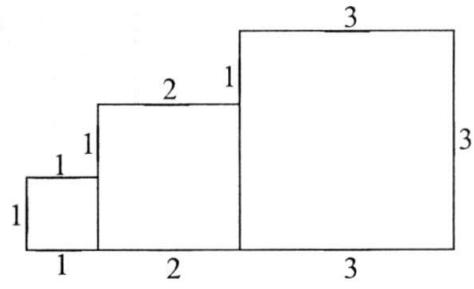


Figure 3

Figure (n)	Length (L)	Perimeter (P)
1	1	4
2	3	10
3	6	18
4	10	y
5	z	40

(a) Write down the values of y and z. [1]

(b) Express L in terms of n. [1]

(c) Show that P can be expressed as $3n + n^2$. [2]

(d) Find the area of the figure when $P = 70$ units. [2]

10 The diagram shows the relative display sizes of iPhone 6 and iPhone 6 Plus as advertised on their website. The iPhone 6 has a diagonal display size of 4.7 inches, while the iPhone 6 Plus has a diagonal display size of 5.5 inches.

iPhone 6

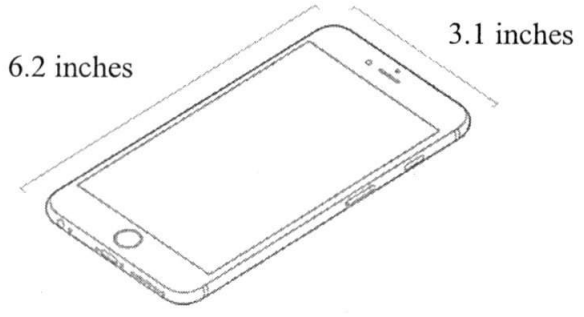
iPhone 6 Plus

(source: http://www.apple.com/sg/iphone-6s/specs/)

(a) Given that the diagonal display size of the iPhone 6 Plus in centimetres is 13.97 cm, calculate the diagonal display size of the iPhone 6 in centimetres. [2]

(b) If the length of the iPhone 6 Plus display is 4.8 inches, find the width of the iPhone 6 Plus display in inches, correct to 1 decimal place. [2]

The website also shows the dimension of the entire phone. In the diagram below, the dimensions of the iPhone 6 Plus are given as 6.2 inches by 3.1 inches. The top surface of the iPhone 6 Plus can be modelled as shown in Figure 1 below, where the corners are identical quadrants with radius 0.4 inches.



Dimensions of iPhone 6 Plus

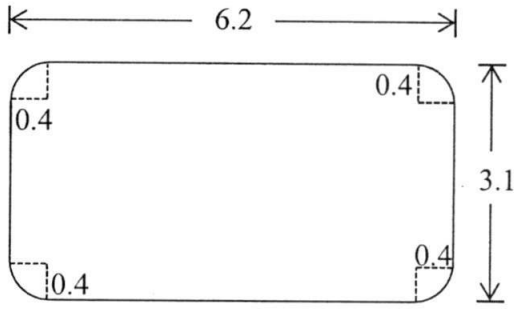


Figure 1

(source: http://www.apple.com/sg/iphone-6s/specs/)

(c) **(i)** Find the top surface area of the iPhone 6 Plus model in Figure 1, in square inches. [2]

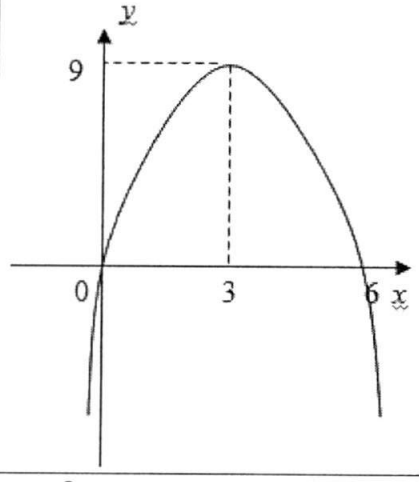
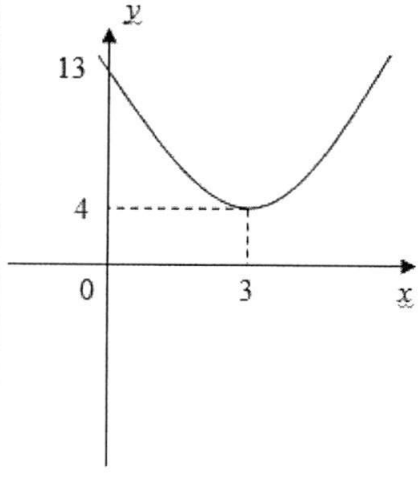
(ii) **Hence**, calculate the surface area of the iPhone 6 Plus display as a percentage of its top surface area. [2]

END OF PAPER

2016 3E E.Math Paper 1 Marking Scheme

	Solution	Mark	Remark
1(a)	$\frac{\sqrt[3]{0.1257}-0.258^2}{1.5^{3.41}}=0.10898$	B1	
1(b)	0.1090	B1	
2	$12x^2y^2-1-3x^2+4y^2$ $=12x^2y^2+4y^2-3x^2-1$ $=4y^2(3x^2+1)-(3x^2+1)$ $=(3x^2+1)(4y^2-1)$ $=(3x^2+1)(2y-1)(2y+1)$	 M1 A1	
3	$1000\text{ cm}^3 = p\text{ cents}$ $1\text{ cm}^3=\frac{p}{1000}\text{ cents}$ $q\text{ cm}^3=\frac{pq}{1000}\text{ cents}$ $1\text{barrel}=\$\frac{pq}{100000}$	 M1 M1 A1	
4(a)	$k=27$	B1	
4(b)(i)	$\frac{1}{y^2}\times\frac{y^3}{3}$ $=\frac{y}{3}$	M1 A1	
4(b)(ii)	$2\div\frac{6}{5x^{-3}}$ $=2\times\frac{5x^{-3}}{6}$ $=\frac{5}{3x^3}\text{ or }\frac{5x^{-3}}{3}$	 M1 A1	
4(c)	$\sqrt[6]{x^7}+\frac{\sqrt{x^5}}{\sqrt[3]{x^4}}$ $=x^{\frac{7}{6}}+x^{\frac{5}{2}-\frac{4}{3}}$ $=x^{\frac{7}{6}}+x^{\frac{7}{6}}$ $=2x^{\frac{7}{6}}$ $=2\left(\sqrt[6]{x^7}\right)$	 M1 M1 A1	
5	$\frac{2}{(1-2x)^2}-\frac{3}{2x-1}$ $=\frac{2}{(1-2x)^2}+\frac{3(1-2x)}{(1-2x)^2}$	 M1	

	$= \dfrac{5-6x}{(1-2x)^2}$	A1	
6(a)	30	B1	
6(b)	$2^2 \times 3^2 \times 5^3 \times 7$	B1	
6(c)	10	B1	
7(a)	20000	B1	
7(b)	2.5 km	B1	
7(c)	187.5 cm^2	B1	
8(a)	$(x-6)^2 - 27$	B1	
8(b)	$(x-6)^2 = 27$ $x = 6 \pm \sqrt{27}$ $x = 0.80$ or 11.20	M1 A2	
9	Any suitable method $x = 3$ $y = -1$	M1 A1 A1	
10(a)	$x - 2 < 2x + 7$ $\qquad 2x + 7 \leq \dfrac{3x+8}{3}$ $x > -9$ $\qquad x \leq -4\dfrac{1}{3}$ $-9 < x \leq -4\dfrac{1}{3}$	M1 M1 A1	
10(b)	-8	B1	
11	$\dfrac{1}{5} + \dfrac{1}{7} = \dfrac{12}{35}$ $1 \div \left(\dfrac{12}{35}\right) = \dfrac{35}{12}$ $\dfrac{35}{12} = 2\dfrac{11}{12}$ mins $= 2$ mins 55 s	M1 M1 A1	
12(a)	15	B1	
12(b)	23	B1	
12(c)	$\dfrac{4x+55}{2x+59} = 1$ $x = 2$	M1 A1	
13	$\dfrac{15x-20-3x+15}{15} = -\dfrac{4}{7}$ $84x = -25$ $x = -\dfrac{25}{84} / -0.298$	M1 A1	

14(a)	$\frac{4}{5}$	B1	
14(b)	$BE = \sqrt{13^2 - 5^2} = 12$ $\tan \angle BCE = \frac{12}{5}$	M1 A1	
14(c)	$\cos \angle ABE = -\cos \angle CBE = -\frac{12}{13}$	B1	
15(a)(i)		B1 (Shape) B1 (Points)	
15(a)(ii)	$x = 3$		
15(b)(i)		B1 (Shape) B1 (Points)	
15(b)(ii)	$(3, 4)$	B1	
16(a)	3.74×10^8 years	B1	
16(b)	$\frac{4}{3}\pi(0.125)^3$ $= 0.00818 \text{ cm}^3$	M1 A1	
16(c)	$\frac{8325 \times 10^{-6}}{3600}$ $= 2.31 \times 10^{-6}$ km/s	M1 A1	
17(a)	0006 / 12.06 am, Thursday	B1, B1	

17(b)	$\frac{3281}{51\frac{53}{60}}$ $= 63.2$ km/h	M1 A1	
18	$B = kr^2$ $1 = kR^2$ $k = \frac{1}{R^2}$ $B_{new} = \frac{1}{R^2}(4R)^2$ $B_{new} = 16$ $\frac{16-1}{1} \times 100\% = 15 \times 100\% = 1500\%$	M1 M1 A1	
19	$A + B : C$ $\quad$ $A : B + C$ $7 : 5$ $\quad$ $8 : 13$ $49 : 35$ $\quad$ $32 : 52$ $A : B : C$ $32 : 17 : 35$ 17 units = 34 marbles 84 units = 168 marbles	M1 M1 A1	
20(a)	$\frac{128}{100} \times 1188$ $= \$1520.64$	M1 A1	
20(b)	107% = \$129.90 100% = \$121.40 110% = \$121.40 100% = \$110.37	M1 A1	
21(a)	$(-7, -2)$	B1	
21(b)	$y = -2$	B1	
21(c)	$D(d, 0)$ $2d = -12$ $d = -6$ $D(-6, 0)$	 B1	
21(d)	$\sqrt{(-3+7)^2 + (-2-1)^2}$ $= 5$ units	 B1	
21(e)	Gradient $= \frac{-2-1}{-3+7} = -\frac{3}{4}$ $y = -\frac{3}{4}x + c$ $1 = \frac{21}{4} + c$	M1	

	$c = -4\frac{1}{4}$ $y = -\frac{3}{4}x - 4\frac{1}{4}$	A1	
21(f)	$E\left(0, -4\frac{1}{4}\right)$	B1	

ANG MO KIO SECONDARY SCHOOL
MID YEAR EXAMINATION 2016
SECONDARY THREE EXPRESS
PAPER 2 SOLUTIONS

NO	ANSWERS	MARKS
1(ai)	$3x^2 - 507 = 0$ $x^2 = 169$ $x = \pm 13$	 M1 A1
1(aii)	$\frac{x-2}{x+3} - \frac{x-3}{12+4x} = 5$ $\frac{x-2}{x+3} - \frac{x-3}{4(3+x)} = 5$ $\frac{4(x-2)-x+3}{4(x+3)} = 5$ $4(x-2)-x+3 = 20(x+3)$ $x = -3\frac{14}{17}$	 M1 M1 A1
1(bi)	$f = 3\times10^{-2}$ or 0.03	B1
1(bii)	$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ $\frac{1}{v} = \frac{1}{f} - \frac{1}{u}$ $\frac{1}{v} = \frac{u-f}{uf}$ $v = \frac{uf}{u-f}$ or $v = \left(\frac{1}{f} - \frac{1}{u}\right)^{-1}$	 M1 (combining into one fraction) A1
1(c)	$\frac{8m+3n}{3n-2m} = \frac{3}{2}$ $2(8m+3n) = 3(3n-2m)$ $\frac{m}{n} = \frac{3}{22}$	 M1 A1
1(d)	$(x-2y)^2 = x^2 - 4xy + 4y^2$ $(3)^2 = 1 - 4xy$ $xy = -2$	 M1 A1
1(ei)	$a + 30 = c$	B1
1(eii)	$2.4a + 1.6c = 228$	B1
1(eii)	Any Method $a = 45,\ c = 75$	M1 A1,A1

2(a)(i)	$\frac{1}{9c^{-2}} \times \frac{(3d)^{-1}}{c^3}$ $= \frac{1}{9c^{-2}} \times \frac{1}{3dc^3}$ $= \frac{1}{27cd}$	 M1 A1
2(a)(ii)	$\frac{5f^2g^3}{21gh} \div \frac{40f^5g^2}{7h^3}$ $= \frac{5f^2g^3}{21gh} \times \frac{7h^3}{40f^5g^2}$ $= \frac{h^2}{24f^3}$	 M1 A1
2(bi)	5	B1
2(bii)	– 21	B1
2(biii)	49	B1
2(c)(i)	$2.25(z+z+2) \leq 126$ $z \leq 27$	M1 A1
2(c)(ii)	29	B1
3(a)	$\frac{2000}{x}$	B1
3(b)	$\frac{2000}{x+1.5}$	B1
3(c)	$\frac{2000}{x} - \frac{2000}{x+1.5} = 13$ $3000 = 13(x^2+1.5x)$ $26x^2+39x-6000=0$	M1 M1 M1
3(d)	$x = \frac{-39 \pm \sqrt{625521}}{52}$ $x = 14.46$ or $x = -15.96$	M1 A1,A1
3(e)	188 hours	B1

4(a)	$A = 7000\left(1+\frac{0.8}{100}\right)^8$ $= \$7460.75$	M1 A1
4(b)	$\text{Total Loan} = 23000 + \frac{23000\times 2.5\times 8}{100}$ $= \$27600$ $\text{Monthly Installment} = \frac{276000}{8\times 12}$ $= \$287.50$	M1 M1 A1
4(c)	June → $€7000\times 6.03 = 42210\,\text{SKR}$ July → $42210\div 5.71 = €7392.29$ Profit = €392.29	M1 A1
4(d)	1st year → $7000\times 0.88 = \$6160$ 2nd year → $6160\times 0.8 = \$4928$ Loss = \$2072	M1 A1
5(ai)	$CE = \sqrt{120^2+120^2}$ $= 170\,\text{cm}$	M1 A1
5(aii)	$\tan\angle BDF = \frac{50}{\sqrt{120^2+120^2}}$ $\angle BDF = 16.4°$	M1 A1
5(aiii)	$AF = AD = 130$ $DF = CE = \sqrt{120^2+120^2}$ $\angle DAF = \cos^{-1}\frac{130^2+130^2-\left(\sqrt{120^2+120^2}\right)^2}{2(130)(130)}$ $= 81.5°$	M1 M1 A1
5(bi)	$ZVX = 50°$ (alt angle) $\angle ZYX = 39+50 = 89°$	M1 A1
5(bii)	$\angle VWX = \frac{180-50°}{2} = 65°$ (isos triangle) $\angle ZYX = 65-39 = 26°$ (alt angle)	M1 A1

6(a)	12 cm	B1
6(bi)	$V = \frac{1}{3}\pi(6^2)(6)$ $= 226\,\text{cm}^3$	M1 A1
6(bii)	$V = \frac{2}{3}\pi(6^3)$ $= 452\ \text{cm}^3$	M1 A1
6(biii)	$V = \pi(6^2)(12) - \frac{1}{3}\pi(6^2)(6) - \frac{2}{3}\pi(6^3)$ $= 679\ \text{cm}^3$	M1 A1
6(c)	$SA = 2\pi(6)(12) + 2\pi(6^2) + \pi(6)\left(\sqrt{6^2+6^2}\right)$ $= 839\ \text{cm}^2$	M1,M1,M1 A1
7(ai)	$\angle PQR = 70 + 50 = 120°$	M1
7(aii)	$A = \frac{1}{2}(90)(200)(\sin 120)$ $= 7790\ \text{cm}^2$	M1 A1
7(b)	$PR^2 = 200^2 + 90^2 - 2(200)(90)(\cos 120)$ $PR = 257$	M2 A1
7(c)	$\frac{\sin\angle QRP}{90} = \frac{\sin 120}{257}$ $\angle QRP = 17.65752082$ $bearing = 17.65752082 + 50 + 180$ $= 247.6°$	M1 M1 A1
7(d)	$7790 = \frac{1}{2}(257)(QX)$ $QX = 60.6225681\ \text{cm}^2$ $\tan\vartheta = \frac{3}{60.6225681}$ $\vartheta = 2.8°$	M1 (or by using trigo ratio to find QX) M1 A1

8(ai)	6 units^2	B1
8(aii)	$KL = \sqrt{3^2 + 6^2}$ $6 = \frac{1}{2} \times \sqrt{6^2 + 3^2} \times h$ $h = 1.79$ units	M1 M1 A1
8(b)	$x = 1$	B1
8(c)	Gradient of LX $= \frac{-4-6}{1-6} = 2$ Gradient of ZX $= \frac{6}{6-3} = 2$ Since Gradient of LX = Gradient of ZX, points Z, L, X lie on the same line.	M1 (either gradient) A1
9(a)	$y = 28$ $z = 15$	B1 (both)
9(b)	$L = \frac{n^2 + n}{2}$	B1
9(c)	$P = 2L + 2n$ $= n^2 + n + 2n$ $= 3n + n^2$	M1 A1
9(d)	$3n + n^2 = 70$ $3n + n^2 - 70 = 0$ or by guess and $(n+10)(n-7) = 0$ $n = 7$ check $A = 1^2 + 2^2 + ... + 7^2$ $= 140$ units^2	M1 A1
10(a)	5.5" → 13.97 cm 4.7" → $\frac{13.97}{5.5} \times 4.7$ $= 11.938$ cm	M1 A1
10(b)	Width $= \sqrt{5.5^2 - 4.8^2}$ $= 2.7$"	M1 A1

10(ci)	$A = (6.2)(3.1) - 4\left[0.4^2 - \frac{1}{4}\pi(0.4)^2\right]$ $= 19.1$ inches square	M1 (excess area) A1
10(cii)	$\%\ of\ \text{S.A.} = \frac{(4.8)(\sqrt{5.5^2 - 4.8^2})}{19.08265482} \times 100\%$ $= 67.5\%$	M1 A1