

Visit
FREETESTPAPER.com
for more papers



Website: freetestpaper.com



[Facebook.com/freetestpaper](https://www.facebook.com/freetestpaper)



[Twitter.com/freetestpaper](https://www.twitter.com/freetestpaper)

Mathematical Formulae**Compound Interest**

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

Mensuration

$$\text{Curved Surface area of cone} = \pi r l$$

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

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

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

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

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

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

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 questionsFor
Examiner's
Use

- 1 Evaluate $(7.43 \times 10^{-3}) \div (9.65 \times 10^7)$.
Give your answer in standard form.

For
Examiner's
Use

Answer _____ [1]

- 2 Alicia and Bert took a multiple choice test.
The matrices show the results of the test and the marks awarded.

	Correct	No attempt	Incorrect		Marks
Alicia	13	0	7	Correct	$\begin{pmatrix} 2 \\ 0 \\ -1 \end{pmatrix}$
Bert	12	5	3	No attempt	
				Incorrect	

(a) Find $\begin{pmatrix} 13 & 0 & 7 \\ 12 & 5 & 3 \end{pmatrix} \begin{pmatrix} 2 \\ 0 \\ -1 \end{pmatrix}$.

Answer (a) _____ [1]

- (b) Explain what your answer in (a) represents.

Answer (b) _____

[1]

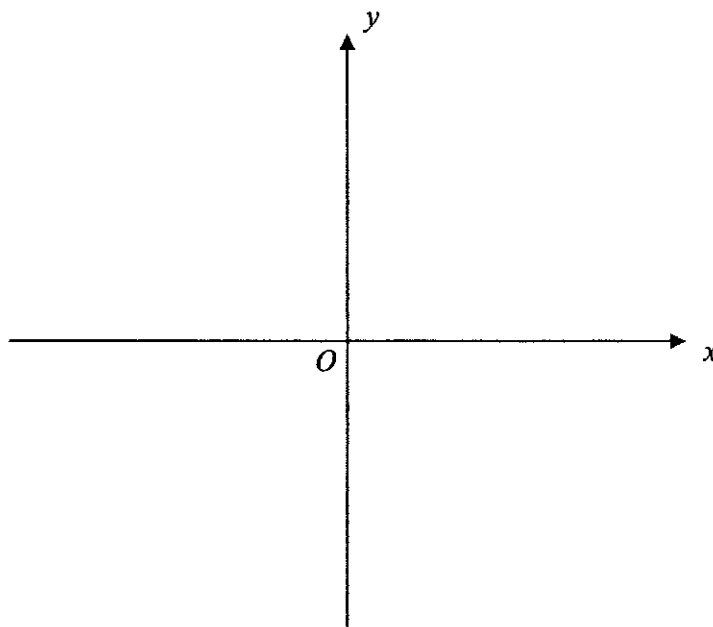
For
Examiner's
Use

- 3 Given that h is 40% of k , find the value of $\frac{3h}{5k}$, expressing your answer as a fraction in its lowest term.

For
Examiner's
Use

Answer _____ [2]

- 4 (a) Sketch the graph of $y = -(x-2)(x+4)$ in the axes provided, labeling the x and y intercepts and turning point clearly. [2]



- (b) Write down the equation of the line of symmetry of $y = -(x-2)(x+4)$.

Answer (b) _____ [1]

For
Examiner's
Use**5** Written as the product of its prime factors

$$3528 = 2^3 \times 3^2 \times 7^2.$$

For
Examiner's
Use

- (a) Express 756 as the product of its prime factors, leaving your answer in index notation.

Answer (a) _____ [1]

- (b) Find

- (i) the greatest integer that will divide 3528 and 756 exactly,

Answer (b)(i) _____ [1]

- (ii) the smallest possible value of k such that $\frac{3528}{k}$ is a perfect square.

Answer (b)(ii) $k =$ _____ [1]

6 It is given that $S = \frac{6t}{5}(n^2 - m^3)$.

- (a) Evaluate S when $t = 1.5$, $n = 6.1$ and $m = 2.3$.

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

- (b) Express n in terms of S , t and m .

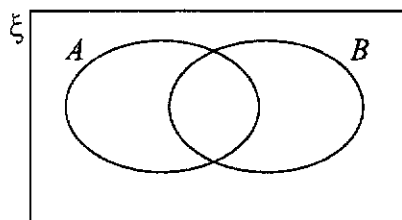
Answer (b) $n =$ _____ [2]

For
Examiner's
Use

- 7 (a) On the Venn Diagram shown in the answer space, shade the set $A' \cap B$.

For
Examiner's
Use

Answer



[1]

- (b) Given $\xi = \{x : x \text{ is an integer such that } 2 < x < 20\}$,
 $A = \{x : x \text{ is a prime number}\}$,
 $B = \{x : x \text{ is a multiple of 6}\}$ and
 $C = \{x : 4(x-1) > 20\}$.

Find

- (i) $(B \cap C)$,

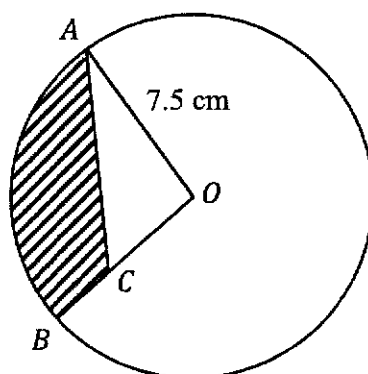
Answer (b)(i) _____ [1]

- (ii) the element(s) x such that $x \in (B \cup C)'$ and that $x \notin A$.

Answer (b)(ii) $x =$ _____ [2]

For
Examiner's
Use

- 8 In the diagram, O is the centre of a circle with radius 7.5 cm.
The area of minor sector AOB is $15\pi \text{ cm}^2$.
 C is a point on OB such that BC is 2.8 cm.

For
Examiner's
Use

- (a) Show that the angle AOB is approximately 1.676 radians.

Answer

[2]

- (b) Calculate the area of the shaded region.

Answer (b) _____ cm^2 [3]

For
Examiner's
Use

9 (a) Solve $(x-5)^2 = 64$.

For
Examiner's
Use

Answer (a) $x =$ _____ or _____ [2]

(b) Solve the following inequality $\frac{2x}{3} > \frac{3x-4}{2}$.

Answer (b) _____ [2]

10 Simplify

(a) $\frac{4a^3}{9bc} \div \frac{8a}{3c^2}$,

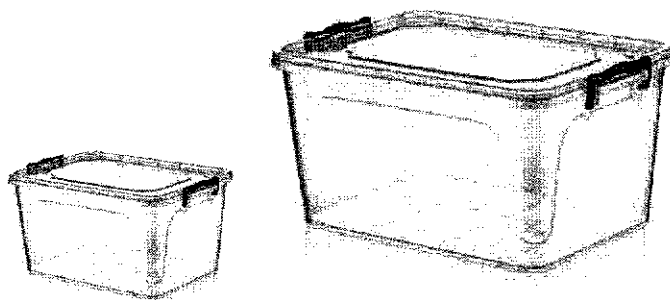
Answer (a) _____ [2]

(b) $\frac{3y}{(3y-2)^2} - \frac{2}{3y-2}$.

Answer (b) _____ [2]

For
Examiner's
Use

- 11 Two similar containers have base areas of 100 cm^2 and 256 cm^2 .

For
Examiner's
Use

- (a) Find the ratio of the height of the smaller container to the height of the larger container.

Answer (a) _____ : _____ [1]

- (b) The total surface area of the smaller container is 450 cm^2 .
Find the total surface area of the larger container.

Answer (b) _____ cm^2 [2]

- (c) The capacity of the larger container is 5.12 litres.
Find the capacity of the smaller container.
Give your answer in cubic centimetres.

Answer (c) _____ cm^3 [2]

For
Examiner's
UseFor
Examiner's
Use

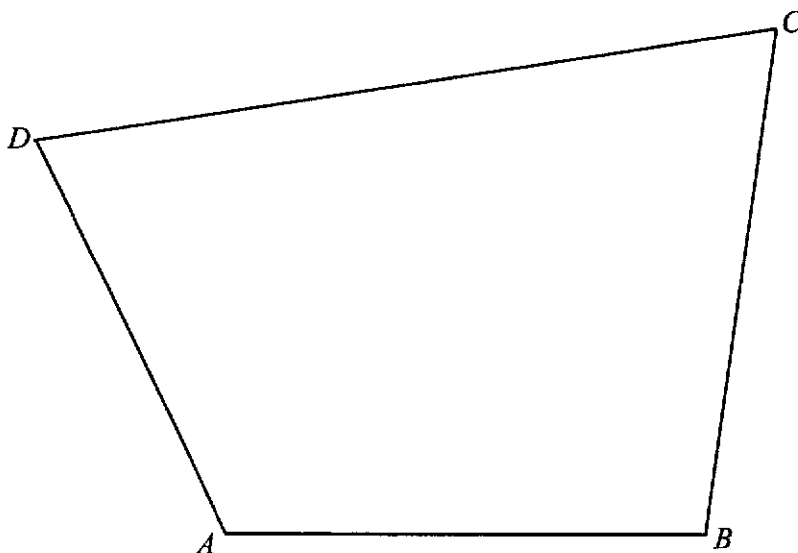
- 12** The diagram shown is the scale drawing of a campsite.
The quadrilateral $ABCD$ is drawn to a scale of 1 cm to 10 m.

- (a) Construct the perpendicular bisector of the line segment BC . [1]
- (b) Construct the angle bisector of angle BAD . [1]
- (c) A flagpole F is located at the intersection of the perpendicular bisector of the line segment BC and the angle bisector of angle BAD .
Find the actual distance, in metres, of the flagpole from point B .

Answer (c) _____ m [1]

- (d) Two taps T_1 and T_2 are to be installed at the campsite.
The taps must be 56 m from point D and equidistant from AB and AD .
On the diagram, label the positions of T_1 and T_2 . [2]

Answer (a), (b) and (d)



For
Examiner's
Use

13 (a) Factorise $4x^2 + 5x - 6$.

For
Examiner's
Use

Answer (a) [2]

(b) Solve the following simultaneous equations.

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

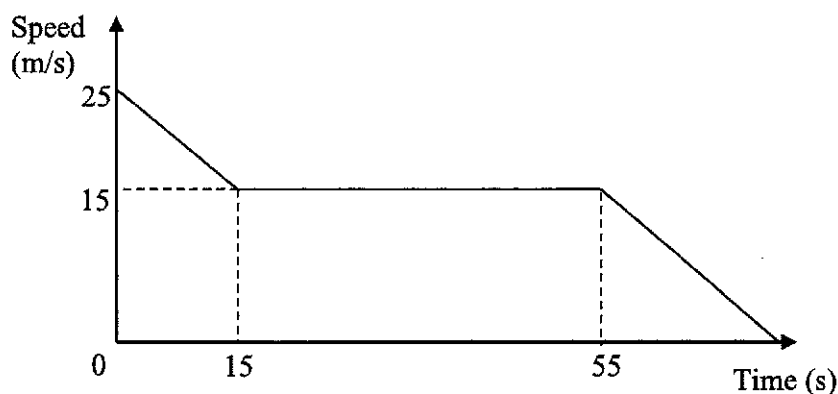
$$6x + 2y = 7$$

Answer (b) $x =$

$y =$ [3]

For
Examiner's
UseFor
Examiner's
Use

- 14** The diagram shows the speed-time graph of a vehicle which slows down constantly from a speed of 25 m/s in 15 seconds. It then travels at constant speed of 15 m/s for 40 seconds before coming to a rest at a constant retardation of 0.45 m/s^2 .



- (a) Calculate the deceleration of the vehicle after 5 seconds.

Answer (a) _____ m/s^2 [2]

- (b) Find the total distance of the car travelled in the first 55 seconds.

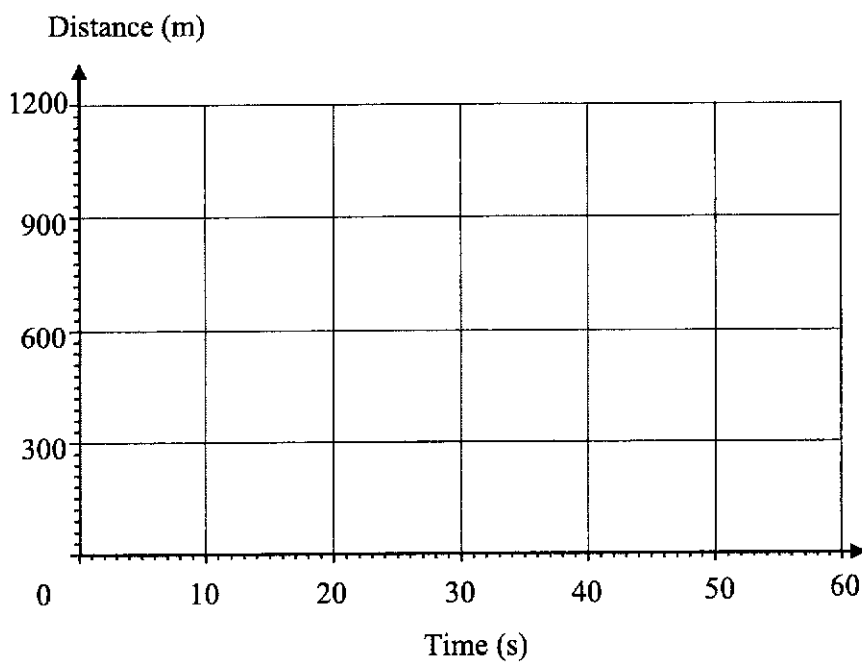
Answer (b) _____ m [3]

- (c) Calculate the duration of the retardation of the car before coming to a complete stop.

Answer (c) _____ s [1]

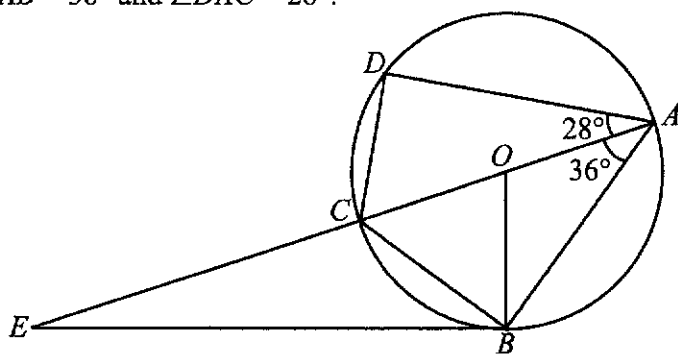
For
Examiner's
Use

- (d) Use the grid below to sketch the distance-time graph for the first 55 seconds of the journey. [2]

For
Examiner's
Use

For
Examiner's
Use

- 15** In the diagram, A, B, C and D lie on the circumference of the circle with centre O .
The diameter AC produced meets the tangent at B at the point E .
 $\angle OAB = 36^\circ$ and $\angle DAC = 28^\circ$.

For
Examiner's
Use

Find, giving reasons for each answer,

- (a) angle BOC ,

Answer (a) _____ $^\circ$ [1]

- (b) angle BCD ,

Answer (b) _____ $^\circ$ [1]

- (c) angle BEC ,

Answer (c) _____ $^\circ$ [1]

- (d) angle DBC ,

Answer (d) _____ $^\circ$ [1]

- (e) angle ECB .

Answer (e) _____ $^\circ$ [2]

End of Paper

Mathematical Formulae**Compound Interest**

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

Mensuration

$$\text{Curved Surface area of cone} = \pi r l$$

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

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

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

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

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

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

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

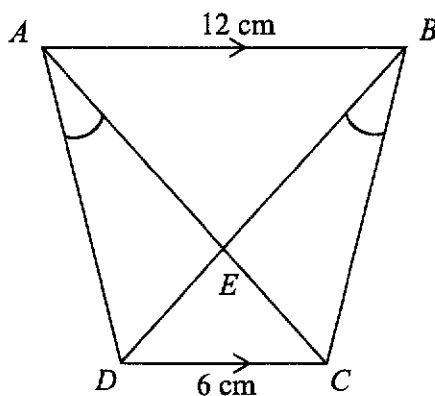
1 (a) Simplify $\frac{9ky + 6kx - 6hy - 4hx}{12x^2 - 27y^2}$. [3]

(b) Solve the equation $\frac{3}{2-y} - \frac{1}{3y+4} = 5$. [3]

- 2 (a) Mr Tan bought 20 books for \$100. 15 of which were then sold at \$3.50 each while the rest for \$x each. If Mr Tan made a profit of 7.5%, find x. [2]

- (b) A set of dining table cost \$1200. Mr Tan paid by hire-purchase with a deposit of 10% and made monthly instalments with 3% simple interest charged per annum for 2 years. How much was the monthly instalment? [3]

- 3 The diagram below shows a right trapezium $ABCD$ where $AB = 12$ cm, $DC = 6$ cm and AB is parallel to DC . The diagonals AC and BD meet at E . Angle $DAC =$ Angle CBD



- (a) Show that triangle AEB is similar to triangle CED . [2]

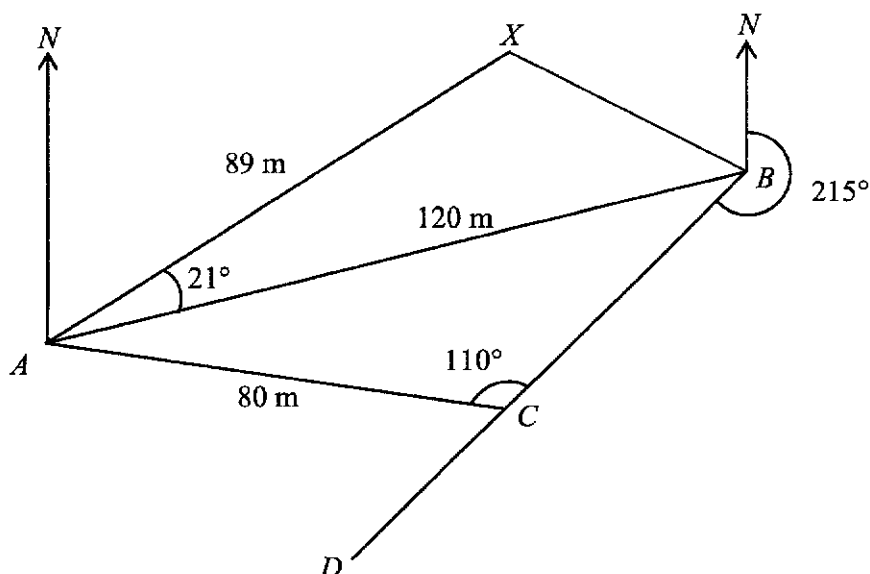
- (b) Name two pairs of congruent triangles from the diagram. [2]

- (c) Given that the area of triangle $CED = 15$ cm², find the area of

- (i) triangle AEB , [2]

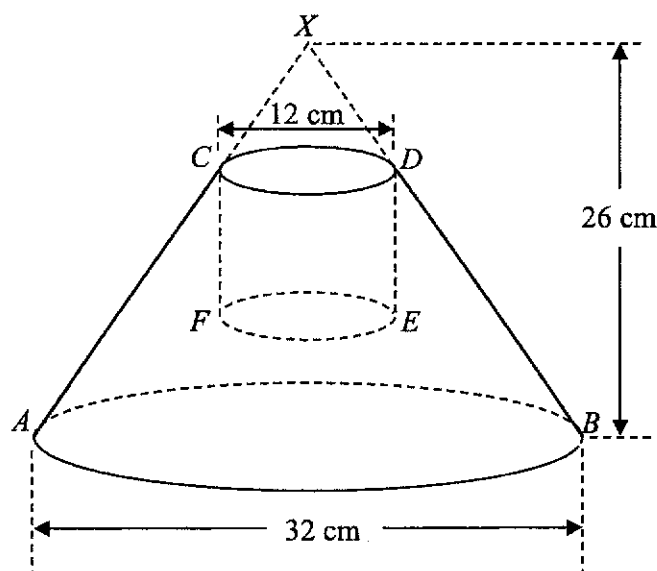
- (ii) trapezium $ABCD$. [3]

- 4 A, B, C and X are points on level ground as shown in the diagram.
 $AB = 120$ m, $AC = 80$ m, $AX = 89$ m, angle $ACB = 110^\circ$, angle $XAB = 21^\circ$ and the bearing of C from B is 215° .



- (a) Find the
- (i) angle ABC , [2]
 - (ii) bearing of B from A , [2]
 - (iii) length BX , [2]
 - (iv) area of triangle ABC . [2]
- (b) A vertical tower AT stands at A . The angle of depression of B from T is 20° , find the height of the tower. [2]
- (c) D is a point on BC produced such that the angle of elevation of T from D is the greatest. Calculate the angle of elevation of T from D . [3]

- 5 In the diagram below, the cone CXD is cut off from the cone AXB to form a frustum $ACDB$. A cylindrical hole $CDEF$ is then drilled into the frustum to form an ornamental container. The vertex X is directly above the centre of the circular base. The base diameter and the height of the bigger solid cone AXB are 32 cm and 26 cm respectively. The base diameter of the smaller solid cone CXD is 12 cm and the curved surface area of the cylindrical hole is 120π cm².



- (a) Show that the height of the cone CXD is 9.75 cm. [1]
- (b) The cost of paint needed to paint the curved surface of the bigger cone AXB is \$32. If the smaller cone CXD is retained as a cover to the container, calculate the cost of paint that was used to paint the curved surface area of the smaller cone CXD . [2]
- (c) Find
- the length of CF , [2]
 - the length of AC . [3]
- (d) Calculate the volume of the open ornamental container, in terms of π . [3]
-
- 6 (a) A straight line l has equation $3y - 2x = 5$.
Find the equation of a line parallel to l and passes through the point $(-1, 4)$. [3]
- (b) The distance between two points $A(k, 2)$ and $B(1, 0)$ is $\sqrt{2k + 2}$ units.
Find the values of k . [3]

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

The table below shows the corresponding x and y values for the graph of $y = 2^x - 9$.

x	-2	-1	0	1	2	3	4	5
y	-8.75	-8.5	r	-7	-5	-1	7	23

- (a) Calculate the value of r . [1]
- (b) Using a scale of 2 cm to represent 1 unit, draw a horizontal x -axis for $-2 \leq x \leq 5$.
Using a scale of 2 cm to represent 5 units, draw a vertical y -axis for $-10 \leq y \leq 25$.
On your axes, plot the points given in the table and join them with a smooth graph of $y = 2^x - 9$. [3]
- (c) By drawing a tangent, find the gradient of the curve at $(2, -5)$. [2]
- (d) Use your graph to find
- (i) the range of positive values of x for which $2^x < 14$, [2]
- (ii) the values of x for which $2^x = 5x - 1$. [3]

8 A shopkeeper bought n pencils for \$52.

- (a) Find an expression in terms of n , for the cost, in dollars, of each pencil. [1]
- (b) The shopkeeper bought another 150 pens. Given that each pen costs 2 cents more than a pencil, show that the total cost of the 150 pens is $\$ \left(\frac{7800 + 3n}{n} \right)$. [2]
- (c) The shopkeeper sold all his pens and pencils at \$1 each. He made an overall profit of \$165.
Write down an equation to represent this information, and show that it simplifies to
- $$n^2 - 70n - 7800 = 0. \quad [3]$$
- (d) Solve the equation $n^2 - 70n - 7800 = 0$. [3]
- (e) Find the cost of each pencil. [1]

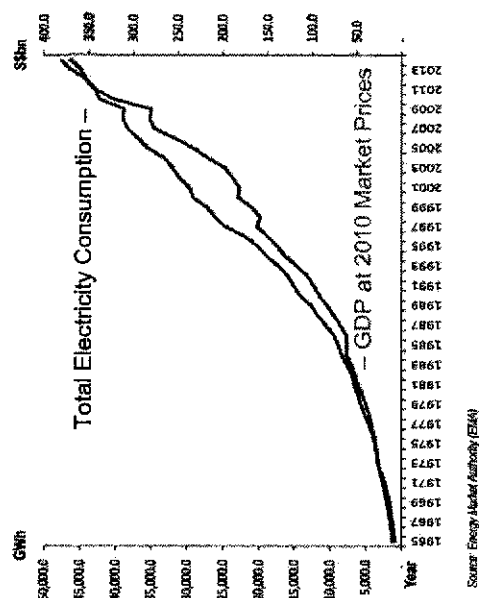
9

Refer to the picture below to answer the questions that follow.

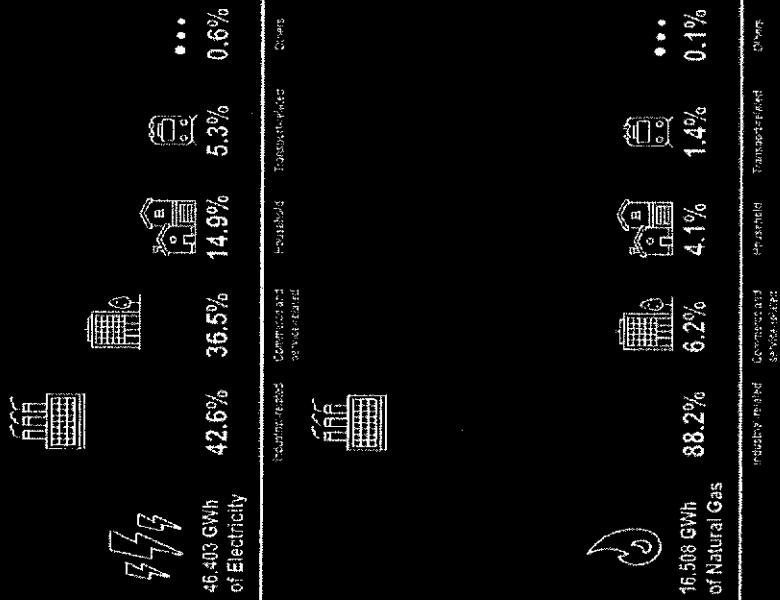
OUR ELECTRICITY DEMAND

Since our independence, our energy demand has steadily and dramatically increased. This has required us to source for more cost-effective energy and use it more efficiently. To do this, we began liberalising our energy market in the 1990s, to encourage competition and greater efficiency.

In 2014 alone, Singapore consumed a total of 46,403 gigawatt-hours (GWh) of electricity, 50 times more than in 1965.



SINGAPORE'S ENERGY CONSUMPTION IN 2014



- 9 (a) What is the total energy consumption of Singapore in 2014? [1]
- (b) (i) What was the electricity consumption (in GWh) of Singapore in 1965?
Give your answer in standard form. [2]
- (ii) What is the percentage increase of Singapore's electricity consumption in 2014 from 1965? [1]
- (c) The table below shows part of the utilities bill of Mr Tan and his family for the month of May.

CURRENT MONTH CHARGES	RATE (\$) on 12-01-2010	USAGE
Electricity Services	0.2287 / kWh	288 kWh
Gas Services	0.1892 / kWh	70 kWh
Water Services	1.17 / m ³	18.8 CuM
Waterborne Fee	0.2803 / m ³	
Water Conservation Tax	30% of charges for water service.	

In the following month of June, the consumption of gas increased to 85 kWh, that of electricity decreased by 15% and while the consumption of water remained unchanged, the 'Water Services' charges increased to \$1.20 / m³.

Mr. Tan predicted it would be lesser charges for June.

Calculate, correct to 2 decimal places, the percentage change in Mr. Tan's utilities bill, inclusive of GST 7%, as compared to the month of May, stating whether you agree or disagree with Mr. Tan providing sufficient evidence.

[5]

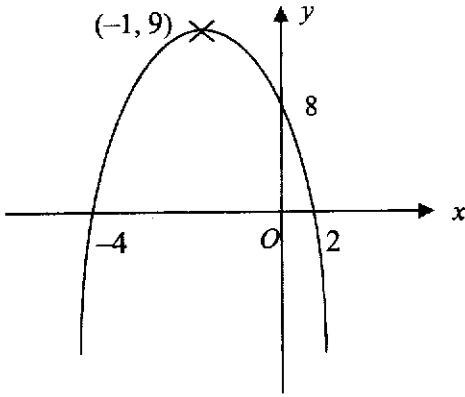
End of Paper



Anglo-Chinese School
(Barker Road)

Marking Scheme
Secondary 3 Express EM
End-Of-Year Exams

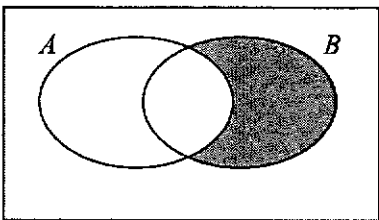
Paper 1

Qn	Answers		
1	7.70×10^{-11}		
2a	$\begin{pmatrix} 19 \\ 21 \end{pmatrix}$		
2b	The total marks that Alicia and Bert scored respectively OR The total marks that <u>Alicia and Bert</u> <u>each</u> scored/ scored <u>individually</u> .		
3	$\frac{3h}{5k} = \frac{3 \times \frac{40}{100} k}{5k}$ $= \frac{6}{25}$		
4a	 B1 – Correct curve sketch B1 – Points are correctly labelled.		
4b	$x = -1$		
5a	$2^2 \times 3^3 \times 7$		
5bi	252		
5bii	2/ 0.5		
6a	45.0774		
6b	$n^2 - m^3 = \frac{5S}{6t}$ $n^2 = \frac{5S}{6t} + m^3$ $n = \pm \sqrt{\frac{5S}{6t} + m^3} \quad \text{or} \quad \pm \sqrt{\frac{5S + 6tm^3}{6t}}$		



Anglo-Chinese School
(Barker Road)

Marking Scheme
Secondary 3 Express EM
End-Of-Year Exams

7a	ξ 		
7bi	$B = \{6, 12, 18\}$ $C = \{x : x > 6\}$ $= \{7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19\}$ $B \cap C = \{12, 18\}$		
7bii	$(B \cup C) = \{6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19\}$ $(B \cup C)' = \{3, 4, 5\}$ 4		
8a	$\frac{1}{2}(7.5)^2 \theta = 15\pi$ $\theta = \frac{15\pi(2)}{(7.5)^2}$ $= 1.676 \text{ rad. (shown)}$		
8b	$15\pi - 0.5(7.5)(4.7)\sin 1.676$ $= 29.6 \text{ cm}^2$		
9a	$(x-5)^2 = 64$ $(x-5) = \pm\sqrt{64}$ $x = 5 + 8 \text{ or } x = 5 - 8$ $x = \underline{13} \text{ or } x = \underline{-3}$		
9b	$4x > 9x - 12$ $12 > 9x - 4x$ $x < 2.4 \text{ or } x < 2\frac{2}{5}$		
10a	$\frac{4a^3}{9bc} \times \frac{3c^2}{8a}$ $= \frac{a^2c}{6b}$		



Anglo-Chinese School
(Barker Road)

Marking Scheme
Secondary 3 Express EM
End-Of-Year Exams

10b	$\frac{3y-2(3y-2)}{(3y-2)^2}$ $= \frac{3y-6y+4}{(3y-2)^2}$ $= \frac{-3y+4}{(3y-2)^2}$		
11a	<u>Base area of smaller container</u> <u>Base area of larger container</u> $= \frac{100}{256} = \frac{25}{64} = \left(\frac{5}{8}\right)^2$ <u>Height of smaller container</u> = $\frac{5}{8}$ <u>Height of larger container</u> Ratio = 5 : 8		
11b	$450 \times \frac{256}{100}$ $= 1152 \text{ cm}^2$		
11c	$5.12 \times \left(\frac{5}{8}\right)^3$ $= 1.25 \text{ litres}$ $= 1250 \text{ cm}^3$		
12	See attached Appendix A. $BF = 57 \sim 59 \text{ m}$		
13a	Cross method or Box method $(4x-3)(x+2)$		
13b	Elimination method or substitution method $x = \frac{3}{4}$ or 0.75 $y = 1\frac{1}{4}$ or 1.25		
14a	$\frac{25-15}{15}$ $= 0.667 \text{ m/s}^2 \text{ (to 3 s.f.)}$		
14b	$0.5(25+15)15+15(40)$ $= 300 + 600$		



Anglo-Chinese School
(Barker Road)

Marking Scheme
Secondary 3 Express EM
End-Of-Year Exams

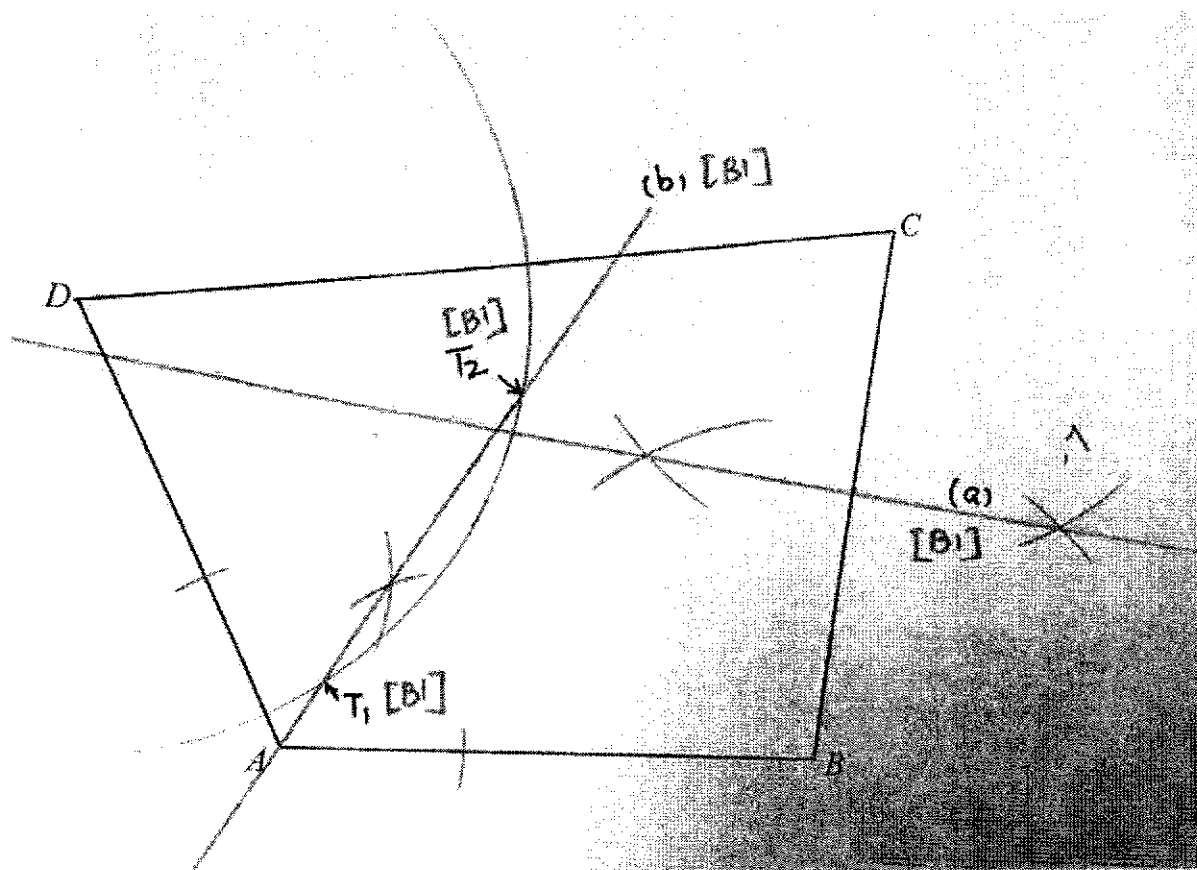
	$= 900 \text{ m}$		
14c	$\frac{15}{0.45} = t$ $t = 33\frac{1}{3}$		
14d	Refer to Appendix B		
15a	$\angle BOC = 2(36^\circ)$ $(\angle \text{ at centre} = 2 \angle \text{ at circumference})$ $= 72^\circ$		
15b	$\angle BCD = 180^\circ - 28^\circ - 36^\circ \text{ } (\angle \text{ s in opp segment})$ $= 116^\circ$		
15c	$\angle OBE = 90^\circ \text{ (tangent } \perp \text{ rad)}$ $\angle BEC = 180^\circ - 90^\circ - 72^\circ \text{ } (\angle \text{ s sum of triangle})$ $= 18^\circ$		
15d	$\angle DBC = \angle DAC \text{ } (\angle \text{ s in same segment})$ $= 28^\circ$		
15e	$\angle ABC = 90^\circ \text{ (Right angle in a semicircle)}$ $\angle ECB = 90^\circ + 36^\circ \text{ (Ext. angle)}$ $= 126^\circ$		



Anglo-Chinese School
(Barker Road)

Marking Scheme
Secondary 3 Express EM
End-Of-Year Exams

Q12



$BF = 57 \sim 59 \text{ m}$

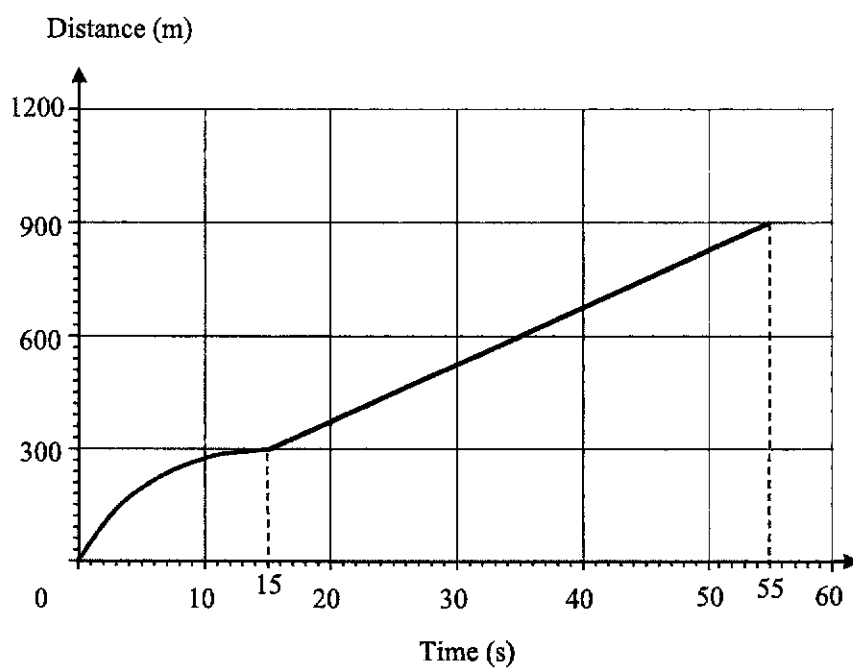
Appendix B



Anglo-Chinese School
(Barker Road)

14d

Marking Scheme
Secondary 3 Express EM
End-Of-Year Exams



B1 – Correct curve drawing from 0 s to 15 s, ending at distance 300 m.
B1 – Correct straight line drawing from 15 s to 55 s, ending at distance 900 m.



Anglo-Chinese School
(Barker Road)

Marking Scheme
Secondary 3 Express EM
End-Of-Year Exams

Paper 2

Qn	Answers		
1a	$\frac{9ky + 6kx - 6hy - 4hx}{12x^2 - 27y^2}$ $= \frac{3k(3y + 2x) - 2h(3y + 2x)}{3(4x^2 - 9y^2)}$ $= \frac{(3k - 2h)(3y + 2x)}{3(2x + 3y)(2x - 3y)}$ $= \frac{3k - 2h}{3(2x - 3y)}$		
1b	$\frac{3}{2 - y} - \frac{1}{3y + 4} = 5$ $\frac{3(3y + 4) - (2 - y)}{(2 - y)(3y + 4)} = 5$ $\frac{9y + 12 - 2 + y}{6y + 8 - 3y^2 - 4y} = 5$ $\frac{10y + 10}{-3y^2 + 2y + 8} = 5$ $\frac{2y + 2}{-3y^2 + 2y + 8} = 1$ $-3y^2 + 2y + 8 = 2y + 2$ $3y^2 - 6 = 0$ $y^2 - 2 = 0$ $y = \pm\sqrt{2}$ $= \pm 1.41$		
2a	Selling price = $\frac{107.5}{100} \times \\100 = \$107.50 $15 \times 3.50 + 5x = 107.50$ $5x = 55$ $x = 11$		
2b	Deposit = $\frac{10}{100} \times 1200$ = \$120 Balance = $1200 - 120$ = \$1080		



Anglo-Chinese School
(Barker Road)

Marking Scheme
Secondary 3 Express EM
End-Of-Year Exams

	$\text{Interest} = \frac{1080 \times 3 \times 2}{100}$ $= \$64.80$ $\text{Monthly installment} = \frac{1080 + 64.80}{24}$ $= \$47.70$		
3a	$\angle AEB = \angle CED$ (vert. opp $\angle$ s) $\angle BAE = \angle DCE$ (alt. $\angle$ s, $AB \parallel DC$) $\angle ABE = \angle CDE$ (alt. $\angle$ s, $AB \parallel DC$) (Any 2 statements with reasons) $\therefore \triangle AEB$ is similar to $\triangle CED$ (AA similarity).		
3b	Triangle AED and triangle BEC Triangle ACD and triangle BDC Triangle ABD and triangle BAC		
3ci	$\frac{\text{Area of } \triangle AEB}{15} = \left(\frac{12}{6}\right)^2$ Area of $\triangle AEB = 60 \text{ cm}^2$		
3cii	Let perpendicular height of $\triangle AEB$ be x . $\frac{1}{2}(x)(12) = 60$ $x = 10 \text{ cm}$ Let perpendicular height of $\triangle CED$ be y . $\frac{1}{2}(y)(6) = 15$ $y = 5 \text{ cm}$ $\Rightarrow$ perpendicular height of trapezium $= 10 + 5 = 15 \text{ cm}$ $\therefore$ Area of trapezium $ABCD$ $= \frac{1}{2}(12 + 6)(15)$ $= 135 \text{ cm}^2$		
4ai	$\frac{\sin \angle ABC}{80} = \frac{\sin 110^\circ}{120}$		



Marking Scheme
Secondary 3 Express EM

Anglo-Chinese School (Barker Road) End-Of-Year Exams

	$\sin \angle ABC = \frac{80 \sin 110^\circ}{120}$ $\sin \angle ABC = 0.626461747$ $\angle ABC = 38.78955642^\circ$ $\angle ABC = 38.8^\circ$		
4a ii	$360^\circ - 215^\circ - 38.78955642^\circ$ $= 106.2104436^\circ$ $\therefore \text{bearing of } B \text{ from } A =$ $180^\circ - 106.2104436^\circ$ $= 073.8^\circ$		
4a iii	$BX^2 = 89^2 + 120^2 - 2(89)(120)\cos 21^\circ$ $BX^2 = 2379.72209$ $BX = 48.8 \text{ m}$		
4a iv	$\text{area of } \triangle ABC =$ $\frac{1}{2}(80)(120)\sin 31.21044358^\circ$ $= 2487.277978 \text{ m}^2$ $= 2490 \text{ m}^2$		
4b	$\tan 20^\circ = \frac{AT}{120}$ $AT = 120 \tan 20^\circ$ $AT = 43.67642811$ $AT = 43.7 \text{ m}$		
4c	$BC = \frac{120}{\sin 110^\circ} \times \sin 31.21^\circ$ $= 66.17264847$ Let AD be the shortest distance of BC from A. $\frac{1}{2}(BC)(AD) = 2487.277978$ $\frac{1}{2}(66.17264847)(AD) = 2487.277978$ $AD = 75.17540964$ $\tan \angle TDA = \frac{AT}{AD}$ $\tan \angle TDA = \frac{43.67642811}{75.17540964}$ $\angle TDA = 30.2^\circ$		



Marking Scheme
Secondary 3 Express EM

Anglo-Chinese School
(Barker Road) End-Of-Year Exams

5a	$\frac{\text{Height}}{26} = \frac{12}{32}$ $\text{Height} = \frac{12}{32} \times 26$ $\text{Height} = 9.75 \text{ cm (shown)}$		
5b	$\frac{\text{Cost of } CXD}{32} = \left(\frac{12}{32}\right)^2$ $\text{Cost} = \$4.50$		
5ci	$2\pi rh = 120\pi$ $2(6)(CF) = 120$ $CF = 10 \text{ cm}$		
5cii	$AX = \sqrt{26^2 + 16^2} = 30.5287$ $CX = \sqrt{6^2 + 9.75^2} = 11.4483$ $AC = 30.5287 - 11.4483$ $= 19.0804$ $\approx 19.1 \text{ cm}$		
5d	Volume of cone AXB $= \frac{1}{3} \pi (16)^2 (26)$ $= 2218 \frac{2}{3} \pi \text{ cm}^3$ Volume of cone CXD $= \frac{1}{3} \pi (6)^2 (9.75)$ $= 117\pi \text{ cm}^3$ Volume of cylindrical Hole $= \pi (6)^2 (10)$ $= 360\pi \text{ cm}^3$ Volume of remaining solid $= 2218 \frac{2}{3} \pi - 117\pi - 360\pi$ $= 1741 \frac{2}{3} \pi \text{ cm}^3$		



Anglo-Chinese School
(Barker Road)

Marking Scheme
Secondary 3 Express EM
End-Of-Year Exams

6a	$y = \frac{2}{3}x + c$ $(4) = \frac{2}{3}(-1) + c$ $c = \frac{14}{3}$ $\therefore y = \frac{2}{3}x + \frac{14}{3}$		
6b	$\sqrt{(k-1)^2 + (2-0)^2} = \sqrt{2k+2}$ $k^2 - 2k + 1 + 4 = 2k + 2$ $k^2 - 4k + 3 = 0$ $(k-1)(k-3) = 0$ $k = 1 \text{ or } k = 3$		
7a	$r = -8$		
7b	All 8 points plotted. Smooth curve through plotted points. See attached.		
7c	Tangent drawn appropriately. Gradient of tangent where $x = 2$ is 2.77		
7di	$2^x < 14$ $2^x - 9 < 5$ Draw line $y = 5$. Range of positive values of x is $0 < x < 3.8$		
7dii	$2^x = 5x - 1$ $2^x - 9 = 5x - 10$ Draw graph of $y = 5x - 10$. $\therefore$ the values of x for which $2^x = 5x - 1$ are $x = 0.5$ and $x = 4.4$		
8a	$\$ \frac{52}{n}$		
8b	$150(\frac{52}{n} + 0.02)$		



Anglo-Chinese School
(Barker Road)

Marking Scheme
Secondary 3 Express EM
End-Of-Year Exams

	$= 150\left(\frac{5200+2n}{100n}\right)$ $= \frac{7800+3n}{n}$		
8c	$(150+n) - \frac{7800+3n}{n} - 52 = 165$ $150n + n^2 - (7800+3n) - 52n = 165n$ $n^2 + 150n - 7800 - 3n - 52n - 165n = 0$ $n^2 - 70n - 7800 = 0 \text{ (shown)}$		
8d	$n^2 - 70n - 7800 = 0$ $n = \frac{70 \pm \sqrt{36100}}{2}$ $= 130 \text{ or } -60$		
8e	$\frac{52}{130}$ $= \$0.40$		

9	(a)	$46,403 + 16508$ $= 62911 \text{ GWh}$		
	(b) i	$\frac{46403}{50}$ $= 928.06 \text{ GWh}$ $= 9.28 \times 10^2 \text{ GWh}$		
	ii	4900%		
	(c)	Calculation of Electrical bill in May and in June (E1): $0.2287 \times 288 \times 1.07 = \70.48 (May) $0.85 \times 288 \times 0.2287 \times 1.07 = \59.90 (June) Calculation of Gas bill in May and in June (G1):		



Anglo-Chinese School
(Barker Road)

Marking Scheme
Secondary 3 Express EM
End-Of-Year Exams

	$0.1892 \times 70 \times 1.07 = \14.17 (May) $0.1892 \times 85 \times 1.07 = \17.21 (June) Calculation of Water bill in May and in June (W1): $[(1.3 \times 1.17 \times 18.8) + (0.2803 \times 18.8)] \times 1.07 = \36.23 (May) $[(1.3 \times 1.20 \times 18.8) + (0.2803 \times 18.8)] \times 1.07 = \37.02 (June) Total Cost in May = \$120.88 Total Cost in June = \$114.13 Percentage decrease: (M1) $\frac{120.88 - 114.13}{120.88} \times 100$ $= 5.5840$ $\approx 5.58\%$ Agree with Mr Tan. (R1)		

Qn7



Anglo-Chinese School
(Barker Road)

Marking Scheme
Secondary 3 Express EM
End-Of-Year Exams

