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Class	Full Name	Index Number
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MID YEAR EXAMINATION 1

O

4048/ 01

I believe, therefore I am

MATHEMATICS

1 hour 30 minutes

Secondary 3 Express

07 May 2015

INSTRUCTIONS TO CANDIDATES

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen.

Answer **all** the 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 answers to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value of 3.142, unless the question requires the answer in terms of π .

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

The number of marks is given in brackets [] at the end of each question or part question.

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

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For Examiner's Use

60

Setter: Mr Dominic Goh

This document consists of **12** printed pages, including this cover page.

Mathematical Formulae*Compound Interest*

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

For
Examiner's
Use

Answer **all** the questions.

For
Examiner's
Use

1 Simplify

(a) $2a^3 \div 3a^4$,

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

(b) $(2b^3)^4 \times \frac{1}{16} b^5$.

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

2 Simplify the following, leaving your answers in positive index.

(a) $\left(\frac{2a^2b^0}{3}\right)^2 \div \left(\frac{3a^4b^{-3}}{2}\right)^3$,

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

(b) $\frac{5}{6} y^{\frac{1}{2}} z^{-\frac{3}{5}} \times \frac{4y^4 z^2}{3}$.

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

For
Examiner's
Use

For
Examiner's
Use

3 Evaluate the following without using a calculator.

(a) $81^{-\frac{1}{4}}$,

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

(b) $\sqrt[3]{125^2}$,

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

(c) $\left(\frac{27}{8}\right)^{\frac{2}{3}}$.

Answer (c).....[2]

4 Solve

(a) $2^{2(x-2)} = 1$,

Answer (a) $x =$[2]

(b) $49^{x+1} = \frac{1}{7^{x+6}}$.

Answer (b) $x =$[2]

For
aminer's
Use

For
Examiner'
Use

- 5 Given that $p = 6.89 \times 10^9$ and $q = 1.28 \times 10^7$, evaluate the following leaving your answers in standard form.

(a) $2p + q$,

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

(b) $\frac{3p}{2q}$.

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

- 6 Kumar deposits \$25, 000 in BDS Bank which pays an interest rate of 3% p.a compounded annually. Calculate how much interest he can get at the end of 36 months.

Answer \$.....[2]

17

For
Examiner's
Use

7 Solve

For
Examiner's
Use

(a) $\frac{2}{x^2-1} + \frac{3}{1-x} = \frac{1}{2},$

Answer (a) $x = \dots\dots\dots$ or $\dots\dots\dots$ [4]

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

Answer (b) $x = \dots\dots\dots$ or $\dots\dots\dots$ [4]

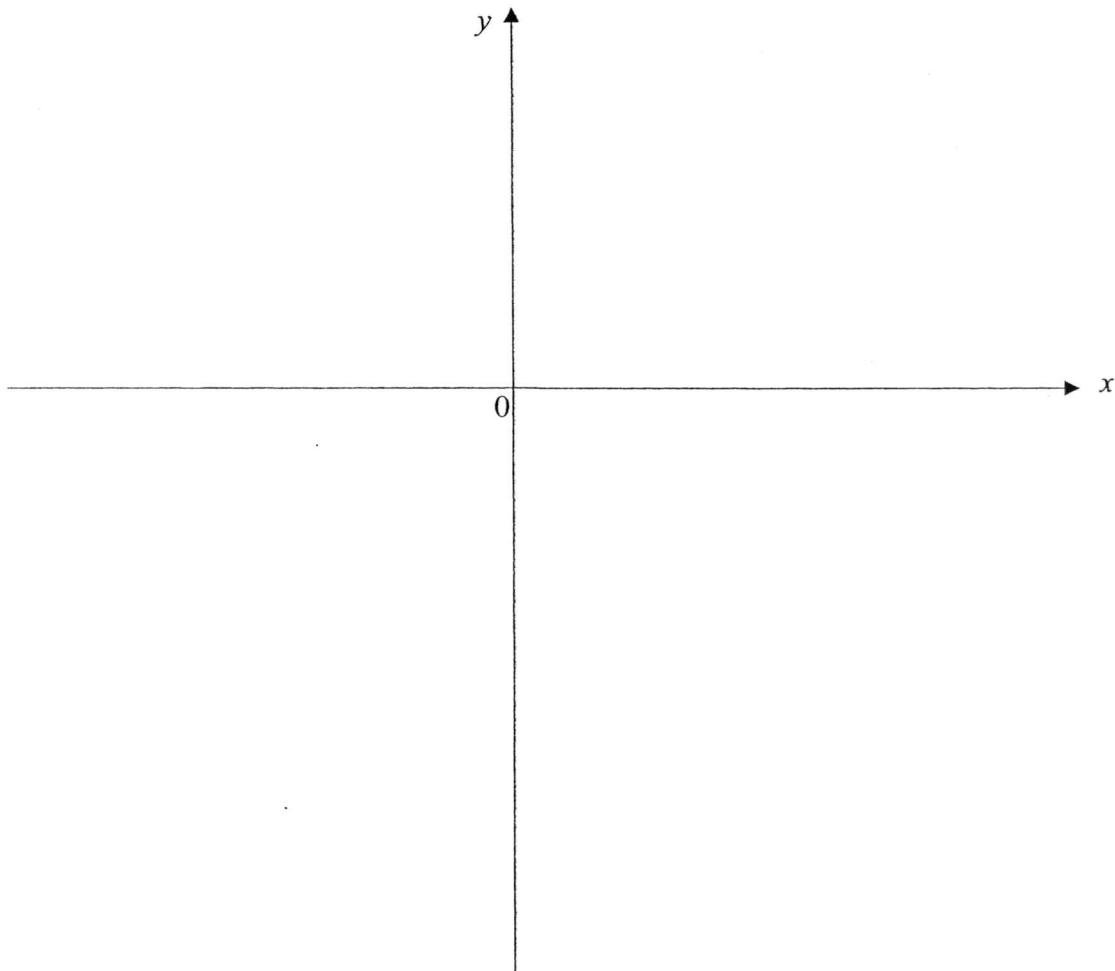
For
Examiner's
Use

For
Examiner's
Use

- 8 (a) Express $y = x^2 + 3x + 2$ in the form of $y = (x + p)^2 - q$.

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

- (b) Sketch the graph of $y = x^2 + 3x + 2$ indicating clearly its intercepts with the axes and its turning point. [2]

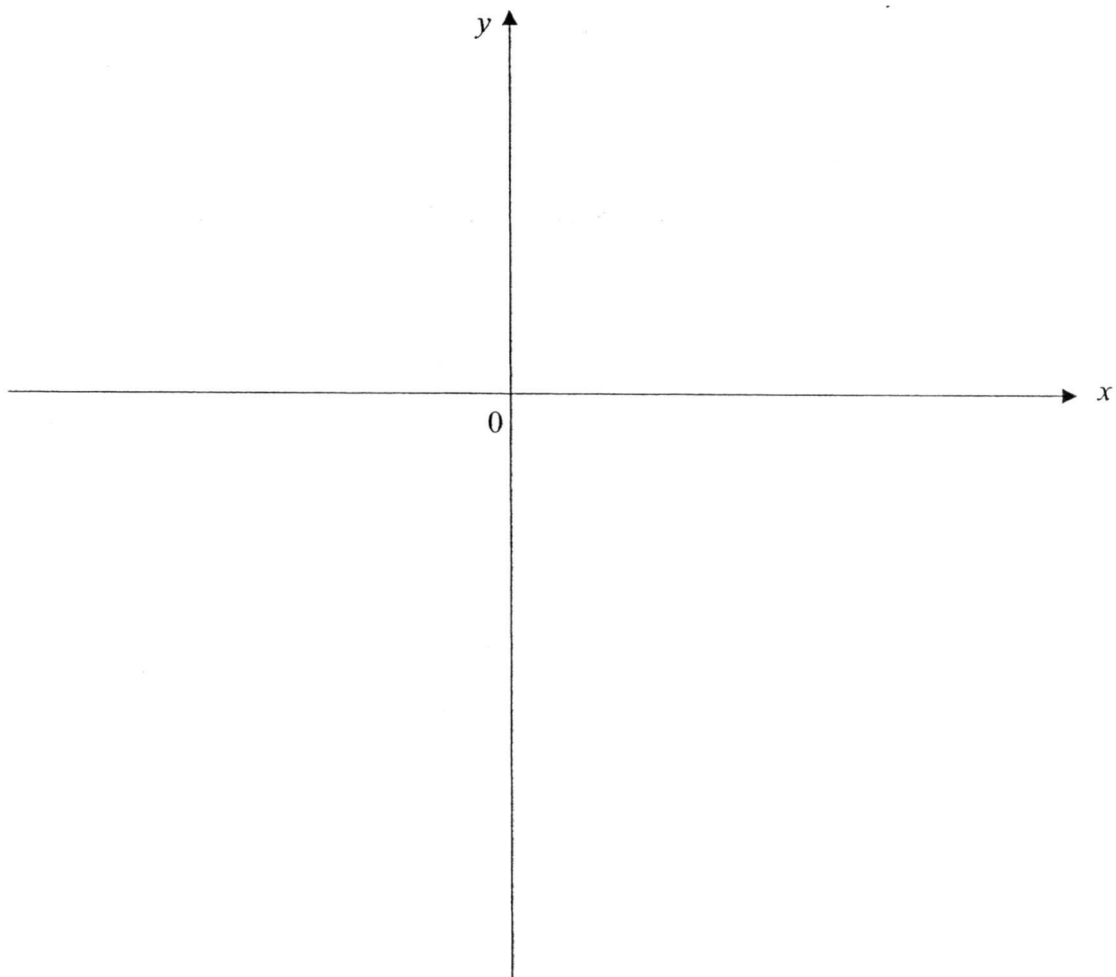


For
examiner's
Use

- 9 Sketch the graph of $y = x^2 + 4x - 5$ indicating clearly its intercepts with the axes and its turning point.

[3]

For
Examiner's
Use



10 (a) Solve the inequalities $3(x - 5) < 2x - 3$ and $2 - x \leq 5x$.

Answer (a).....[3]

(b) Given that $\frac{x-3}{4} \leq \frac{x-2}{3} < \frac{x-1}{4}$, find

- (i) the range of values of x that satisfy the inequality and represent your solutions on a number line.
- (ii) the greatest integer value of x .
- (iii) the largest prime value of x .

Answer (b)(i).....[4]

Number Line _____

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

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

19

For
Examiner's
Use

- 11 The length of a rectangle is $(x + 4)$ cm and its breadth is 6 cm shorter. If the perimeter of the rectangle cannot exceed 48 cm,

- (a) Write down an inequality in x and simplify it.
(b) Hence, write down the largest possible area of the rectangle.

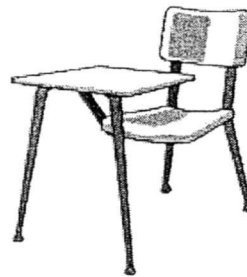
For
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Use

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

Answer (b).....cm²[1]

- 12 The table below shows the cost of desks and chairs from a Tuck Sing Furniture Shop.

Furniture	Cost
Student Desk	\$30 per item
Student Chair	\$25 per item
Transport charges	\$30 per trip

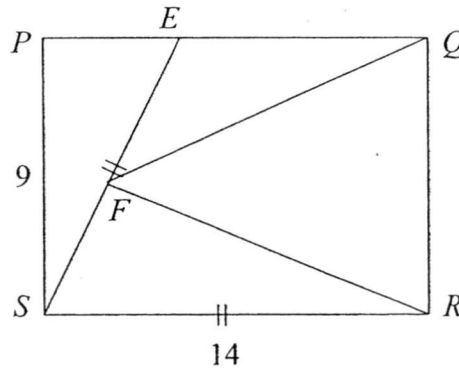


Supervisor, Shantimalar would like to purchase 20 desks and as many chairs as possible given a budget of \$1,200. Using inequality, calculate the maximum number of chairs she can purchase.

Answer[2]

13. In the diagram, $PQRS$ is a rectangle, SFE is a straight line and E lies on PQ . The line RF is perpendicular to the line SE at F . Given that $SE = SR$, $PS = 9$ cm, $SR = 14$ cm and $\angle FSR = \angle FRQ$.

- (a) Identify a pair of congruent triangles and give reasons for your answer.
 (b) Show that $SF = 10.7$ cm.
 (c) Find the area of $EFRQ$.



Answer (a).....[3]

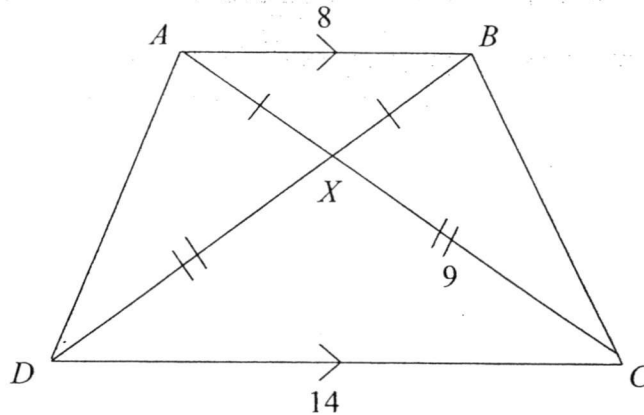
Answer (b).....[1]

Answer (c).....cm²[1]

20

For
Examiner's
Use

- 14 In the diagram, $AB \parallel DC$, AC and BD meet at X , $AX = BX$ and $CX = DX$.



For
Examiner's
Use

- (a) Prove that triangle ABX and CDX are similar.
 (b) Given that $AB = 8$ cm, $DC = 14$ cm and $XC = 9$ cm, find the length of AX .
 (c) Find the area of $\triangle DXC$ if the area of $\triangle BXA = 80$ cm².

Answer (a).....

.....

.....[2]

Answer (b) $AX =$cm[2]

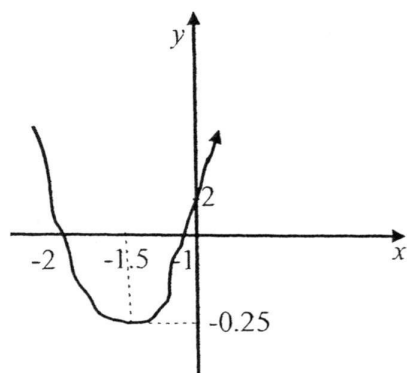
Answer (c).....cm²[2]

END OF PAPER

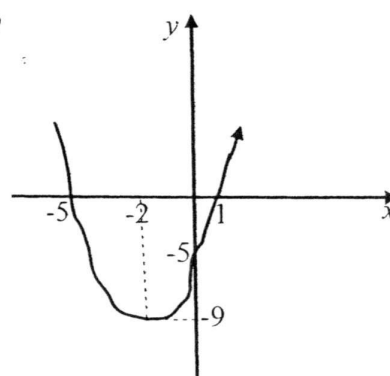
Answer Key

1(a)	$\frac{2}{3a}$	8(a)	$y = (x + \frac{3}{2})^2 - \frac{1}{4}$
(b)	b^{17}	(b)	See below
2(a)	$\frac{8b^9}{243a^8}$	9	See below
(b)	$\frac{10y^{\frac{5}{4}}z^{\frac{7}{5}}}{9}$	10(a)	$\frac{1}{3} \leq x < 12$
3(a)	$\frac{1}{3}$	(b)(i)	$-1 \leq x \leq 5$
(b)	25	(ii)	4
(c)	2.25	(iii)	3
4(a)	$x = 1$	11(a)	$x \leq 11$
(b)	$-2\frac{2}{3}$	(b)	135
5(a)	1.37928×10^{10}	12	22
(b)	8.07×10^2	13(a)	$\triangle PES = \triangle FSR$ Since $\angle FSR = \angle FRO \Rightarrow \angle PSE = \angle SRF$ Since $\angle EPS = \angle SFR (90^\circ)$ and $\angle PSE = \angle SRF$ and $SE = SR$ (s) Implies that Triangle PES = FSR
6	\$2318.175	(b)	Using Pythagoras Theorem, $SF = 10.7$ cm (proven)
7(a)	-0.172 or -5.83	(c)	29.7 cm^2
(b)	-3.19 or 2.19	14(a)	Since $ABD = CBD$ (alt angle), $BAC = ACD$ (Alt angles) and $AXB = CXD$ (Vert opp) Thus Triangle ABX is similar to Triangle CDX (AAA)
		(b)	$5\frac{1}{7}$
		(c)	245

8



9



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Calculator Model :

Class	Full Name	Index Number
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**MID YEAR EXAMINATION
2015**

O
4048/02

**MATHEMATICS
PAPER 2**

**Secondary 3 Express
11 May 2015**

2 hours

Additional Materials: Writing Papers
Graph Paper (1 sheet)

INSTRUCTIONS TO CANDIDATES

Write your name, class and index number on all the work you hand in.
Write your answers and working on the separate Writing Paper provided.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the questions.

The number of marks is given in brackets [] at the end of each question or part question.
The total number of marks for this paper is **80**.

You are expected to use a scientific calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question, and if the answer is not exact,
give the answer to three significant figures.
Give answers in degrees to one decimal place.
For π , use either your calculator value or 3.142.

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

DO NOT OPEN THIS PAPER UNTIL YOU ARE TOLD TO DO SO

Setter : Mdm Joyce Toh

For Examiner's Use

80

This document consists of **9** printed pages, including this cover page.

Mathematical Formulae

Compound interest

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

Mensuration

$$\text{Curve surface area of a cone} = \pi r l$$

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

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

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

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

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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 QUESTIONS.

1 (a) Find the value of $\frac{\sqrt{7.23 \times 10^7 - 1.39 \times 10^{-4}}}{(16^{12})^{\frac{2}{3}}}$, correct to 3 significant figures. [1]

(b) Without using a calculator, evaluate $2^{\frac{3}{2}} \times \sqrt{8} \div 8$. [2]

(c) Pressure is defined as force per unit area, as shown in the formula $P = \frac{F}{A}$.

If $F = 0.00000316$ and $P = 2.5 \times 10^{-5}$,

(i) express P as a decimal. [1]

(ii) Find the value of A and express your answer in standard form. [2]

2 (a) Factorise the following completely.

(i) $x^2 - 49$, [1]

(ii) $x^3 - x^2 - 2x$. [2]

(b) Express the following as a single fraction in its lowest terms. [2]

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

- 3 (a) If 1 litre of air contains 2 762 350 oxygen molecules, how many oxygen molecules are there in 10 millimetres of air? Give your answer in standard form. [2]

- (b) Simplify the following and express your answers in positive index notation.

(i) $\left(\frac{3x^2}{2xy^0}\right)^{-4}$, [2]

(ii) $\left(-3m^2n^{-\frac{2}{3}}\right)^3 \times \sqrt[3]{8mn}$. [2]

- (c) (i) Solve $3^{2x+1} = 1$. [1]

(ii) Given that $2^{x+3} \div \left(\frac{1}{4}\right)^x = 16^5$, find the value of x . [2]

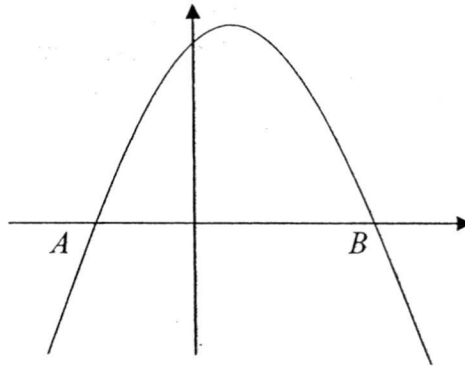
- 4 (a) (i) Express $x^2 - 8x - 29$ in the form $(x - a)^2 - b$ where a and b are constants. [2]

(ii) Hence, solve the equation $x^2 - 8x - 29 = 0$. [2]

(b) Solve the equation $3 + \frac{2}{5-x} = \frac{x-1}{x^2-25}$.

Give your answers correct to 2 decimal places. [4]

- 5 (a) The diagram shows the graph $y = -x^2 + 3x + 4$.
It cuts the x-axis at A and B .



- (i) Find the coordinates of A and B . [2]
- (ii) Find the equation of the line of symmetry for the graph. [1]

- (b) Jerry bought x number of handphones using \$7800.

- (i) Jerry wanted to make a profit of \$500 for each handphone.

Write down an expression for the selling price of each handphone. [1]

- (ii) 6 handphones were found to be faulty. Jerry will only make a profit of \$435 on each of his remaining handphones.

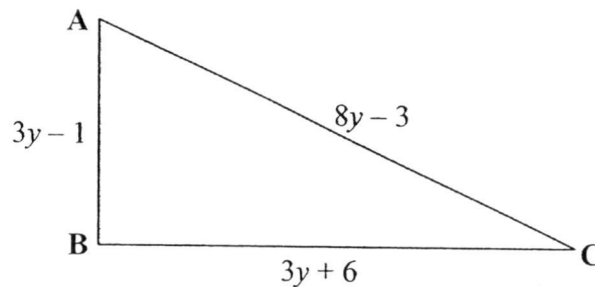
Write down an expression for the selling price of each remaining handphone. [1]

- (iii) If the selling price of each handphone remains the same, form an equation in x and show that it reduces to $x^2 - 6x - 720 = 0$. [2]

- (iv) Solve the equation $x^2 - 6x - 720 = 0$ to find the original number of handphones that Jerry bought. [3]

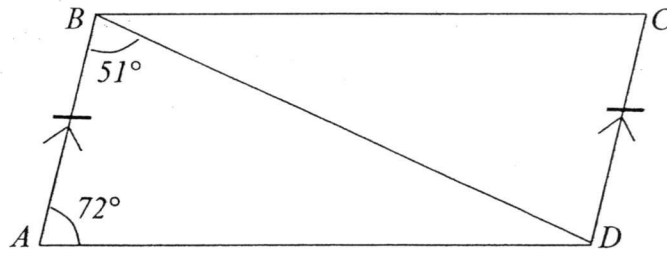
- 6 (a) On 12 September 2013, Denzel invested some money in a bank which pays simple interest at a rate of 3% per annum. He would be able to receive \$573.75 in total interest on 12 December 2015. How much money did Denzel invest in the bank? [2]
- (b) At the same time, Denzel also invested \$12 000 in another bank that pays compound interest at a rate of 2.25% per annum compounded half-yearly. How much money will Denzel get back at the end of 5 years? [2]
-

- 7(a) The diagram shows a $\triangle ABC$ whereby the perimeter of the triangle is not greater than 32 cm.



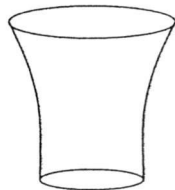
- (i) Form an inequality in terms of y . [1]
- (ii) Solve the inequality. [1]
- (iii) Determine the greatest possible length of **AB** if y is an integer. [1]
- (b) Solve the inequalities $-2 \leq \frac{x}{2} \leq 3$ and $2x < 4x - 10 < 18$. [3]
-

- 8(a) In the diagram, $ABCD$ is a quadrilateral such that AB is parallel to DC . It is given that $AB = DC$, $\angle BAD = 72^\circ$ and $\angle ABD = 51^\circ$.

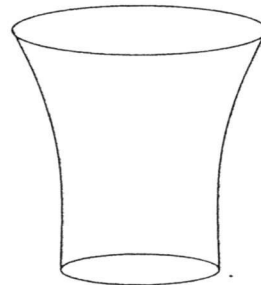


- (i) Stating all your reasons clearly, prove that $\triangle ABD$ is congruent to $\triangle CDB$. [3]
- (ii) Find angle CBD . [2]

- (b) The containers shown below are geometrically similar. The base area of container A is $\frac{9}{25}$ of the base area of container B.



Container A

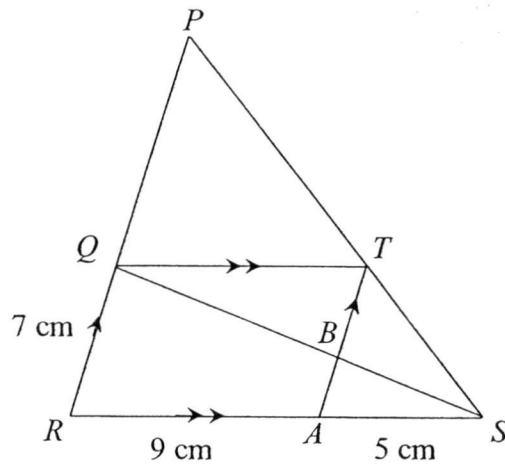


Container B

- (i) Find the ratio of the height of container A to the height of container B. [1]
- (ii) The cost of painting container A is \$0.45, find the cost of painting container B. [1]
- (iii) The containers are completely filled with water. Given that container B holds 1.5 litres of water, calculate the capacity of container A. [2]

9

In the diagram showing $\triangle PRS$, $RQTA$ is a parallelogram and AT meets SQ at B .



- (a) Stating all your reasons clearly, prove that $\triangle PQT$ is similar to $\triangle PRS$. [3]
- (b) Given that $RA = 9$ cm, $AS = 5$ cm and $RQ = 7$ cm,
- find the ratio of $QT : RS$. [1]
 - find the length of QP . [2]
 - find the ratio of $SA : SR$. [1]
 - find the length of BA . [2]
- (c) If the area of $\triangle PRS = 98$ cm²,
- find the ratio of area of $\triangle PQT : \triangle PRS$. [1]
 - find the area of trapezium $QTSR$. [2]

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

The variables x and y are connected by the equation $y = -2x^2 + x + 8$.

x	-2	-1	0	1	2	3
y	-2	p	8	7	2	-7

- (a) Find the value of p . [1]

- (b) Draw the graph of $y = -2x^2 + x + 8$.

Using a scale of 2 cm to represent 1 unit, draw a horizontal x -axis for $-2 \leq x \leq 3$ and a scale of 2 cm to represent 2 units, draw a vertical y -axis for $-8 \leq y \leq 10$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

- (c) For the range of $-2 \leq x \leq 3$, use your graph to

- (i) find the maximum y value of the curve, [1]

- (ii) find the values of x when $y = 1$, [1]

- (iii) solve the equation $-2x^2 + x + 8 = 0$, [2]

- (iv) find solutions of the equation $-2x^2 + x + 3 = 0$ by drawing a suitable straight line on the same axes as your graph. [3]

END OF PAPER

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Answers

- 1(a) 0.00000198 (b) 1
 (c)(i) 0.000025 (ii) 1.264×10^{-1}
- 2(a)(i) $(x - 7)(x + 7)$ (ii) $x(x - 2)(x + 1)$
 (b) $\frac{4}{(x - 7)}$
- 3(a) 2.76235×10^4 (b)(i) $\frac{16}{81x^4}$ (ii) $\frac{-54m^{\frac{19}{3}}}{n^{\frac{5}{3}}}$
 (c)(i) -0.5 (ii) 17/3
- 4(a)(i) $(x - 4)^2 - 45$ (ii) 10.7 or -2.71 (iii) (4, -45)
 (b) 5.82 or -4.82
- 5(a)(i) A (-1, 0) and B (4, 0) (ii) 3/2
 (b)(i) $\frac{7800}{x} + 500$ (ii) $\frac{7800}{x - 6} + 435$
 (iii) $\frac{7800}{x} + 500 = \frac{7800}{x - 6} + 435$ (iv) 30 or -24 (NA), Original number is 30
- 6(a) 8500 (b) 13420.43
- 7(a)(i) $3y - 1 + 8y - 3 + 3y + 6 \leq 32$
 (ii) $y \leq 15/7$ (iii) integer y is 2 and greatest AB = 5cm
 (b) $5 < x \leq 6$
- 8(a)(i) $\triangle ABD \equiv \triangle CDB$ (SAS) (ii) 57°
 (b)(i) 3 : 5 (ii) \$1.25 (iii) 0.324 litres
- 9(a) $\triangle PQT$ is similar to $\triangle PRS$ (AAA)
 (b)(i) 9 : 14 (ii) 12.6cm (iii) 5 : 14
 (iv) 2.5cm
 (c)(i) 81 : 196 (ii) 57.5 cm^2
- 10(a) $p = 3$
 (c)(i) maximum y is 8.125 (accept range for y value 8.05 – 8.5)
 (ii) $x = -1.65$ or $x = 2.15$ (accept range for both x values ± 0.15)
 (iii) $x = -1.8$ or $x = 2.3$ (acceptable range for both x values ± 0.15)
 (iv) draw $y = 5$ and $x = -1$ or $x = 1.5$ (acceptable range ± 0.15)