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Expected Grade :	Marks Awarded :	50	Actual Grade :	Parent's Signature :	

NORTHLAND SECONDARY SCHOOL

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Nurturing Minds, Shaping Character, Strengthening Vigour

MID YEAR EXAMINATION 2014	
Subject : MATHEMATICS	Paper: 1
Level : Secondary 2 Express	Date: 14 May 2014
Setter : Mr. Tan Wei Jia Jackson	Duration : 1 hour 15 minutes
Vetter : Mrs Cindy Toh	Time : 09 00 – 10 15

READ THESE INSTRUCTIONS FIRST

Write your name, index number, class and calculator model in the spaces at the top of the page.
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** questions.
If working is needed for any question it must be shown **neatly and clearly** in the space below the question.
Omission of essential working will result in loss of marks.
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For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

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The total of the marks for this paper is **50**.

For Examiner's Use

This paper consists of **10** printed pages including the cover page and graph paper

Answer **ALL** questions.

For Examiner's Use

1. Written as the product of its prime factors $240 = 2^4 \times 3 \times 5$.

(a) Express 168 as the product of its prime factors.

(b) Find the LCM of 240 and 168, giving your answer as the product of its prime factors.

(c) Given that $240k$ is a perfect cube, find the smallest possible value of k.

(d) En Qi needs to pack 168 blue pens and 240 red pens into identical bags so that the pens are equally distributed among the bags. Find the largest number of bags that can be packed.

Answer: **(a)** _____ [1]

(b) _____ [1]

(c) _____ [1]

(d) _____ bags [1]

For Examiner's Use

2. **(a)** In the number 64 X61, X is a composite number. If the value, correct to 3 significant figures is 65 000, find the maximum value of X.

(b) A glass block has a mass of 53 grams, correct to the nearest gram.
Find the least possible mass of the glass block.

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

(b) _____ g [1]

3. The following table shows the temperature of four cities in United States at 11 00 on a particular day.

Miami	Chicago	Washington	Minneapolis
25 °C	–2 °C	8 °C	–10 °C

(a) Find the difference in temperature between the warmest and coldest cities.

(b) Find the average temperature for these four cities.

(c) It was found that the temperature of Chicago decreased by 0.3 °C every hour after 11 00.
Find the temperature at 15 00.

Answer: **(a)** _____ °C [1]

(b) _____ °C [1]

(c) _____ °C [2]

4. Solve the simultaneous equations.

$$x-2y=-3,$$
$$4x-3y=8.$$

Answer: $x =$ _____

$y =$ _____ [3]

5. **(a)** Lester bought an antique watch for \$450.
When he sold it he made a profit of 160% of the cost.
Calculate the selling price.

(b) The length of each side of a square is increased by 30%.
Find the percentage increase in the area of the square.

Answer: **(a)** \$_____ [2]

(b) _____% [2]

For Examiner's Use

6. x is directly proportional to y^3.
$x = 108$ when $y = 3$.
Find

(a) an equation connecting x and y,

(b) the value of x when $y = 5$.

Answer: **(a)** _____ [2]

(b) $x =$ _____ [1]

7. A sum of money was divided between A, B and C in the ratio 5: 6: 7.
If, instead, this money had been divided equally between them, A would have received an extra \$5.
What was the total sum of money?

Answer: \$_____ [2]

For Examiner's Use

8. Factorise each of the following expressions completely.

(a) $xy-3x+2y-6$

(b) $3m^2n+15mn+18n$

Answer: **(a)** _____ [2]

(b) _____ [2]

9. **(a)** Expand $\left(10r-\frac{1}{5}q\right)\left(10r+\frac{1}{5}q\right)$

(b) Express $\frac{3}{(x+2)^2}-\frac{4}{x+2}$ as a single fraction in its simplest form.

Answer: **(a)** _____ [2]

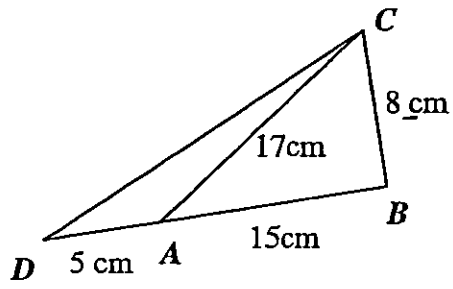
(b) _____ [2]

For Examiner's Use

10. In triangle ABC, $AB = 15$ cm, $BC = 8$ cm and $AC = 17$ cm

(a) Explain why angle ABC is a right angle.

(b) BA is produced to D and $AD = 5$ cm.
Find the length of DC.



Answer: **(a)** _____

_____ [1]

Answer: **(b)** _____cm [2]

11. **(a)** Solve the equation $3(x-5)-2=7-(1-x)$.

(b) Solve the equation $3x^2-14x+8=0$

Answer: **(a)** _____ [2]

(b) _____ [2]

For Examiner's Use

12. Given that $m = \sqrt{\frac{4q}{n-3}}$.

(a) Find the value of m when $q = 12$ and $n = 6$.

(b) Express q in terms of m and n.

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

(b) _____ [2]

13. In a 6-sided polygon, 3 of the interior angles are 85°, 95° and 105°.
The size of each remaining interior angle of the polygon is x°.
Find

(a) the sum of the interior angles of the 6-sided polygon,

(b) the value of x.

Answer: **(a)** _____° [1]

(b) $x =$ _____ [2]

14. **(a)** Construct triangle ABC where $BC = 7.5$ cm and $AC = 8$ cm. [1]
AB has already been drawn for you.

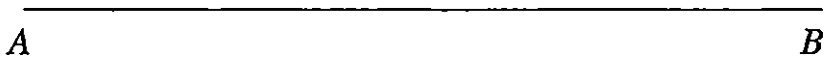
For Examiner's Use

(b) Construct

i) the bisector of angle ABC, [1]

ii) the perpendicular bisector of AB. [1]

(c) These two bisectors meet at Z.
Complete the statement below.



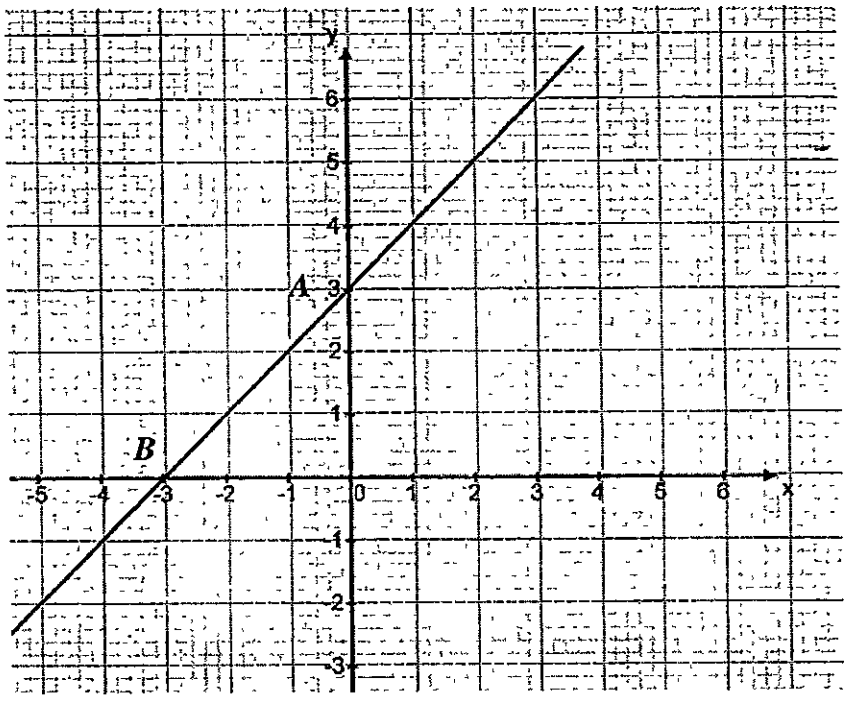
Answer:

(d) The point Z is equidistant from the lines _____ and _____ and [1]

equidistant from the points _____ and _____.

15. The diagram shows a straight line which intersects the y-axis at A and x-axis at B.

For Examiner's Use



(a) Find the gradient of the line.

(b) Write down the equation for this line.

Answer: **(a)** _____ [2]

(b) _____ [1]

- END OF PAPER-

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	(a)	Express 168 as the product of its prime factors.	
	(b)	Find the LCM of 240 and 168, giving your answer as the product of its prime factors.	
	(c)	Given that $240k$ is a perfect cube, find the smallest possible value of k.	
	(d)	En Qi needs to pack 168 blue pens and 240 red pens into identical bags so that the pens are equally distributed among the bags. Find the largest number of bags that can be packed.	

a) $168 = 2^3 \times 3 \times 7$ [B1]

b) $\text{LCM} = 2^4 \times 3 \times 5 \times 7$ [B1]

c)

$$240k = 2^6 \times 3^3 \times 5^3$$
$$(2^4 \times 3 \times 5)k = 2^6 \times 3^3 \times 5^3$$
$$k = \frac{2^6 \times 3^3 \times 5^3}{(2^4 \times 3 \times 5)}$$
$$k = 2^2 \times 3^2 \times 5^2$$
$$k = 900$$ [B1]

d) $\text{HCF} = 2^3 \times 3$
$= 24$ [B1]

	Answer:	**(a)**	_____	[1]	
		(b)	_____	[1]	
		(c)	_____	[1]	
		(d)	_____ bags	[1]	

2. (a) In the number 64 $X61$, X is a composite number. If the value, correct to 3 significant figures is 65 000, find the maximum value of X.

For Examiner's Use

(b) A glass block has a mass of 53 grams, correct to the nearest gram.
Find the least possible mass of the glass.

a) maximum value of $X = 9$ [B1]

b) least possible mass = 52.5 [B1]

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

(b) _____ g [1]

3. The following table shows the temperature of four cities in United States at 11 00 on a particular day.

Miami	Chicago	Washington	Minneapolis
25 °C	–2 °C	8 °C	–10 °C

(a) Find the difference in temperature between the warmest and coldest cities.

(b) Find the average temperature for these four cities.

(c) It was found that the temperature of Chicago decreased by 0.3 °C every hour after 11 00.
Find the temperature at 15 00.

a) $25-(-10)=35$ °C [B1]

b) Average temperature $= \dfrac{25+(-2)+(8)+(-10)}{4}$

$= \dfrac{21}{4}$

$= 5.25$ °C [B1]

c) 11 00 to 15 00 => 4 hours

Temperature at 15 00 $= -2 - 4\,(0.3)$ [M1]

$= -3.2$ °C [A1]

Answer: (a) _____ °C [1]

(b) _____ °C [1]

(c) _____ °C [2]

4. Solve the simultaneous equations.

$$x-2y=-3,$$
$$4x-3y=8.$$

<u>Elimination method</u>

$x-2y=-3$ ...(1)

$4x-3y=8$ ...(2)

(1) $\times 4$: $4x-8y=-12$ ...(3)

(3) – (2) :

$4x-8y-(4x-3y)=-12-8$ [M1]

$-8y+3y=-20$

$-5y=-20$

$y=4$ [A1]

Sub $y=4$ into (1),

$x-2(4)=-3$

$x=5$ [A1]

<u>Substitution method</u>

$x-2y=-3$

$x=-3+2y$...(1)

$4x-3y=8$ ...(2)

Sub (1) into (2),

$4(-3+2y)-3y=8$ [M1]

$-12+8y-3y=8$

$5y=20$

$y=4$ [A1]

Sub $y=4$ into (1),

$x-2(4)=-3$

$x=5$ [A1]

Answer: $x=$ _____

$y=$ _____ [3]

5. **(a)** Lester bought an antique watch for \$450.
When he sold it he made a profit of 160% of the cost.
Calculate the selling price.

(b) The length of each side of a square is increased by 30%.
Find the percentage increase in the area of the square.

a)

Selling price $= \frac{450}{100} \times 260$ [M1]

$= \$1170$ [A1]

b) Let the original length of the square be x,

New length $= 1.3x$

New Area $= 1.3x \times 1.3x$ [M1]

$= 1.69x^2$

percentage increase $= \frac{0.69x^2}{x^2} \times 100\%$

$= 69\%$ [A1]

Answer: **(a)** \$_____ [2]

(b) _____% [2]

6. x is directly proportional to y^3.
$x = 108$ when $y = 3$.
Find

For Examiner's Use

(a) an equation connecting x and y,

(b) the value of x when $y = 5$.

$x = ky^3$

When $x = 108$ and $y = 3$,

$(108) = k(3)^3$

$k = \frac{108}{27}$

$k = 4$ [B1]

$x = 4y^3$ [B1]

$x = 4y^3$

$x = 4(5)^3$

$x = 500$ [B1]

Answer: **(a)** _____ [2]

(b) $x =$ _____ [1]

7. A sum of money was divided between A, B and C in the ratio 5: 6: 7.
If, instead, this money had been divided equally between them, A would have received an extra \$5.
What was the total sum of money?

5 units + 6 units + 7 units = 18 units

18 units ÷ 3 = 6 units [M1]

6 units – 5units = 1 unit

1 unit => \$5

18 units => \$5 × 18

=> \$ 90 [A1]

Answer: \$_____ [2]

8. Factorise each of the following expressions completely.

For Examiner's Use

(a) $xy-3x+2y-6$

(b) $3m^2n+15mn+18n$

$xy-3x+2y-6 = x(y-3)+2(y-3)$ [M1]

$= (x+2)(y-3)$ [A1]

$3m^2n+15mn+18n = 3n(m^2+5m+6)$ [M1]

$= 3n(m+2)(m+3)$ [A1]

Answer: **(a)** _____ [2]

(b) _____ [2]

9. **(a)** Expand $\left(10r-\frac{1}{5}q\right)\left(10r+\frac{1}{5}q\right)$

(b) Express as $\frac{3}{(x+2)^2}-\frac{4}{x+2}$ a single fraction in its simplest form.

$\left(10r-\frac{1}{5}q\right)\left(10r+\frac{1}{5}q\right) = (10r)^2-\left(\frac{1}{5}q\right)^2$ [M1]

$= 100r^2-\frac{q^2}{25}$ [A1]

$\frac{3}{(x+2)^2}-\frac{4}{x+2} = \frac{3-4(x+2)}{(x+2)^2}$ [M1]

$= \frac{3-4x-8}{(x+2)^2}$

$= \frac{-4x-5}{(x+2)^2}$ [A1]

Answer: **(a)** _____ [2]

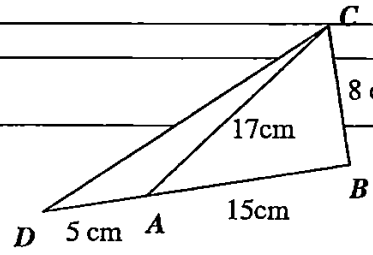
(b) _____ [2]

10. In triangle ABC, $AB = 15$ cm, $BC = 8$ cm and $AC = 17$ cm

For Examiner's Use

(a) Explain why angle ABC is a right angle.

(b) BA is produced to D and $AD = 5$ cm.
Find the length of DC.



$AC^2 = 17^2$
$= 289$
$AB^2 + CB^2 = 15^2 + 8^2$
$= 289$

$DC^2 = DB^2 + CB^2$
$= 20^2 + 8^2$
$= 464$
$DC = 21.540659$
≈ 21.5 (to 3 s.f)

Answer: **(a)** Since $AC^2 = AB^2 + CB^2$, therefore by Pythagoras theorem,

ΔABC is a right angle triangle. [1]

Answer: **(b)** _____ cm [2]

11. **(a)** Solve the equation $3(x-5)-2 = 7-(1-x)$.

(b) Solve the equation $3x^2 - 14x + 8 = 0$

$3(x-5)-2 = 7-(1-x)$
$3x-15-2 = 7-1+x$
$3x-17 = 6+x$
$2x = 23$
$x = 11.5$

$3x^2 - 14x + 8 = 0$
$(3x-2)(x-4) = 0$ [M1]
$(3x-2) = 0$ or $(x-4) = 0$
$3x = 2$ or $x = 4$
$x = \frac{2}{3}$ [A1]

Answer: **(a)** _____ [2]

(b) _____ [2]

12. Given that $m = \sqrt{\dfrac{4q}{n-3}}$.

For Examiner's Use

(a) Find the value of m when $q = 12$ and $n = 6$.

(b) Express q in terms of m and n.

a)

When $n = 6$ and $q = 12$,

$m = \sqrt{\dfrac{4(12)}{6-3}}$

$= \sqrt{\dfrac{48}{3}}$ [M1]

$= \sqrt{16}$

$= 4$ [A1]

b)

$m = \sqrt{\dfrac{4q}{n-3}}$

$m^2 = \dfrac{4q}{n-3}$ [M1]

$m^2(n-3) = 4q$

$q = \dfrac{m^2(n-3)}{4}$ [A1]

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

(b) $n =$ _____ [2]

13. In a 6-sided polygon, 3 of the interior angles are 85°, 95° and 105°.
If the size of each remaining interior angle of the polygon is x°.
Find

(a) the sum of the interior angles of the 6-sided polygon,

(b) the value of x.

Sum of the interior angles $= (n-2)\times 180°$

$= 4\times 180°$

$= 720°$ [B1]

$720° = 85° + 95° + 105° + 3x°$ [M1]

$720° = 285° + 3x°$

$435° = 3x°$

$x = 145$ [A1]

Answer: **(a)** _____ [1]

(b) $x =$ _____ [2]

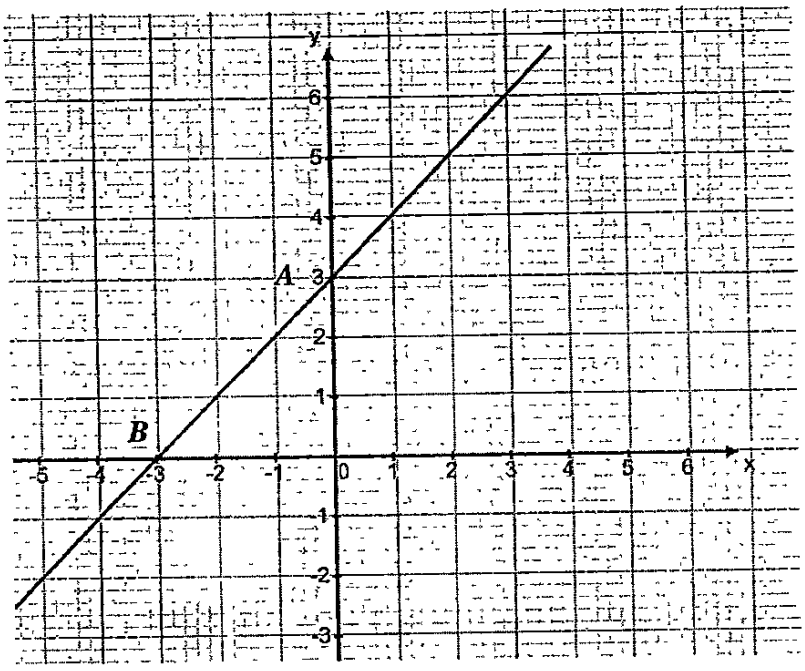
14.	**(a)**	Construct triangle ABC where $BC = 7.5$ cm and $AC = 8$ cm. AB has already been drawn for you.	[1]	*For Examiner's Use*
	(c)	Construct		
		i) the bisector of angle ABC,	[1]	
		ii) the perpendicular bisector of AB.	[1]	
	(d)	These two bisectors meet at Z. Complete the statement below.		

Answer:

(d) The point Z is equidistant from the lines ___AB___ and ___BC___ and equidistant from the points ___A___ and ___B___. [1]

15. The diagram shows a straight line which intersects the y-axis at A and x-axis at B.

For Examiner's Use



(a) Find the gradient of the line.

(b) Write down the equation for this graph.

a)

gradient of the line, $m = \dfrac{(3)-(0)}{(0)-(-3)}$ [M1]

$= 1$ [A1]

b)

$y = mx + c$

$y = 1x + 3$

$y = x + 3$ [B1]

Answer: **(a)** _____ [2]

(b) _____ [1]

- END OF PAPER-

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Subject : MATHEMATICS	Paper: 2
Level : Secondary 2 Express	Date: 14 May 2014
Setter : Mr. Jackson Tan	Duration : 1 hour 15 minutes
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For Examiner's Use

Answer **all** questions.

1. **(a)** 15 blacksmiths can make 30 identical knives. Assuming all the blacksmiths work at the same rate, find the number of identical knives 8 blacksmiths can make. [2]

(b) Urlwin runs 2.2km in 9 minutes and walks 200 m at an average speed of 4 km/h. Calculate

(i) the time, in minutes, he takes to walk the 200 m, [1]

(ii) his average speed for the whole journey in kilometres per hour. [2]

2. **(a)** A two-digit number is such that the sum of its digits is $\frac{1}{4}$ of the number. [4]

When the digits of the number are reversed and the number is subtracted from the original number, the result obtained is -27.
Find the original number.

(b) **(i)** Write down the next two terms in the sequence 1, 3, 6, 10, 15 ... . [1]

(ii) Write down an expression, in terms of n, for the nth term in the sequence. [2]
1, 3, 6, 10, 15 ... .

3. The length of x m of a basketball court has a perimeter of 50 m.

(a) Find an expression, in terms of x, for the breadth of the basketball court. [1]

(b) It was given that the area of the basketball court is 150 m^2. [1]
Write down an equation in x to represent this information, and show that it reduces to $x^2 - 25x + 150 = 0$.

(c) Solve the equation $x^2 - 25x + 150 = 0$. [2]

(d) Find the breadth of the basketball court. [1]

4. **(a)** Simplify $\frac{24x^2}{y} \div \frac{6x^3}{y^2}$ [2]

(b) **(i)** Factorise $7p^2 - 28$ completely. [2]

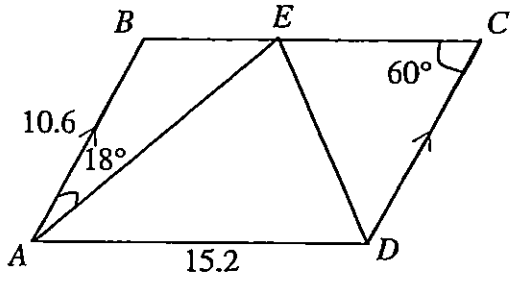
(ii) Hence, simplify $\frac{7p^2 - 28}{p^2 + 2p}$. [2]

5. **(a)** Solve the inequality $2x-25\geq 18+8x$. [2]

(b) Hence write down the greatest odd integer value of x which satisfies $2x-25\geq 18+8x$ [1]

(c) A boat can ferry a maximum of 25 passengers across the river. Find the minimum number of trips that a boat must make to ferry 243 passengers. [2]

6. $ABCD$ is a parallelogram with $AB = 10.6$ cm and $AD = 15.2$ cm. $\angle BAE = 18°$ and $\angle ECD = 60°$.
Find



(a) $\angle ABC$, [1]

(b) $\angle DAE$, [1]

(c) the area of parallelogram $ABCD$, given that its height is 9 cm. [2]

7. Diagram 1 shows an oil tank which is made up of half of a cylinder of radius 1.2 m joined to a cuboid of side 4 m by 2.4 m by 2 m.

(a) Calculate the total surface area of the outside of the tank. [4]

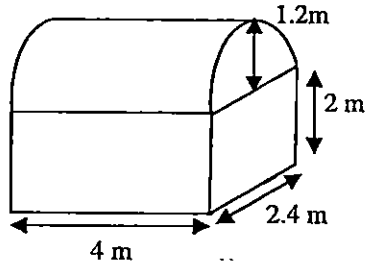


Diagram 1

(b) The tank is filled with petrol.

(i) Calculate the amount of petrol needed to fill the tank in m^3. [3]

(ii) All of the petrol from the tank will fill up an underground storage tank completely. [3]
The storage tank as shown in Diagram 2 is a prism whose cross-section is a trapezium.
The lengths of the parallel sides of the trapezium are 4 m and 3 m.
The depth of the storage tank is 3.2 m
Calculate the length of the underground tank.

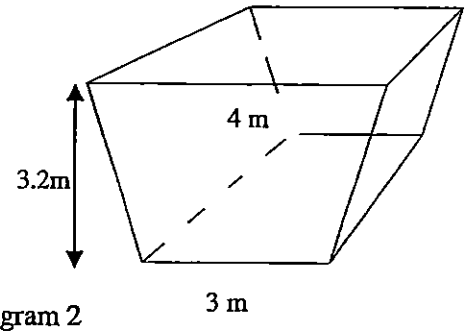


Diagram 2

8. ***Answer the whole of this question on a sheet of graph paper.***

Stevie kicks a soccer ball vertically upwards.
The height, h metres, of the ball at t seconds after it leave the ground is given by the formula $h = 24t - 4t^2$.
The table below shows some values of t and the corresponding values of h.

t	0	1	2	3	4	5
h	0	20	32	m	32	20

(a) Find the value of m. [1]

(b) Using a scale of 2 cm to represent 1 second, draw a horizontal t-axis for $0 \le t \le 6$. [3]
Using a scale of 2 cm to represent 5 metres, draw a vertical h-axis for $0 \le h \le 40$.

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

(c) Use your graph to find
(i) the greatest height of the ball above the ground, [1]
(ii) the length of time for which the ball was more than 20 metres above the ground, [2]
(iii) the time taken for the ball to hit the ground again. [1]

– END OF PAPER –

Name :			Index No :	Class :	Calculator Model :
Expected Grade :	Marks Awarded :	/ 50	Actual Grade :	Parent's Signature :	

NORTHLAND SECONDARY SCHOOL

Motivated Learners, Assets to Community
Nurturing Minds, Shaping Character, Strengthening Vigour

MID YEAR EXAMINATION 2014	
Subject : MATHEMATICS	Paper: 2
Level : Secondary 2 Express	Date: 14 May 2014
Setter : Mr. Jackson Tan	Duration : 1 hour 15 minutes
Vetter : Mrs. Cindy Toh	Time : 11 30 – 12 45

READ THESE INSTRUCTIONS FIRST

Write your index number and name 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, highlighters, glue or correction fluid.

Answer **ALL** questions on the writing paper provided.
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 **50**.

For Examiner's Use

This paper consists of 4 printed pages including the cover page

Answer **all** questions.

1. **(a)** 15 blacksmiths can make 30 identical knives. Assuming all the blacksmiths work at the same rate, find the number of identical knives 8 blacksmiths can make. [2]

(b) Urlwin runs 2.2km in 9 minutes and walks 200 m at an average speed of 4 km/h. Calculate

(i) the time, in minutes, he takes to walk the 200 m, [1]

(ii) his average speed for the whole journey in kilometres per hour. [2]

2. **(a)** A two-digit number is such that the sum of its digits is $\frac{1}{4}$ of the number. [4]

When the digits of the number are reversed and the number is subtracted from the original number, the result obtained is -27.
Find the original number.

(b) **(i)** Write down the next two terms in the sequence 1, 3, 6, 10, 15 ... . [1]

(ii) Write down an expression, in terms of n, for the nth term in the sequence. [2]
1, 3, 6, 10, 15 ... .

3. The length of x m of a basketball court has a perimeter of 50 m.

(a) Find an expression, in terms of x, for the breadth of the basketball court. [1]

(b) It was given that the area of the basketball court is 150 m^2. [1]
Write down an equation in x to represent this information, and show that it reduces to $x^2 - 25x + 150 = 0$.

(c) Solve the equation $x^2 - 25x + 150 = 0$. [2]

(d) Find the breadth of the basketball court. [1]

4. **(a)** Simplify $\frac{24x^2}{y} \div \frac{6x^3}{y^2}$ [2]

(b) **(i)** Factorise $7p^2 - 28$ completely. [2]

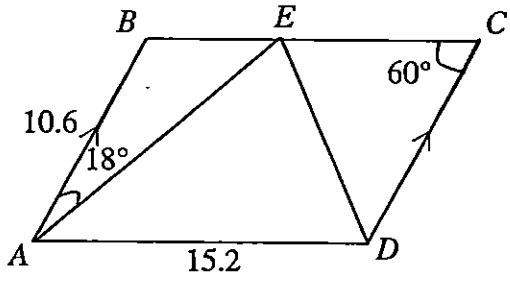
(ii) Hence, simplify $\frac{7p^2 - 28}{p^2 + 2p}$. [2]

5. **(a)** Solve the inequality $2x-25 \geq 18+8x$ [2]

(b) Hence write down the greatest odd integer value of x which satisfies $2x-25 \geq 18+8x$ [1]

(c) A boat can ferry a maximum of 25 passengers across the river. Find the minimum number of trips that a boat must make to ferry 243 passengers. [2]

6. $ABCD$ is a parallelogram with $AB = 10.6$ cm and $AD = 15.2$ cm. $\angle BAE = 18°$ and $\angle ECD = 60°$.
Find



(a) $\angle ABC$, [1]

(b) $\angle DAE$, [1]

(c) the area of parallelogram $ABCD$, given that its height is 9 cm. [2]

7. Diagram 1 shows an oil tank which is made up of half of a cylinder of radius 1.2 m joined to a cuboid of side 4 m by 2.4 m by 2 m.

(a) Calculate the total surface area of the outside of the tank. [4]

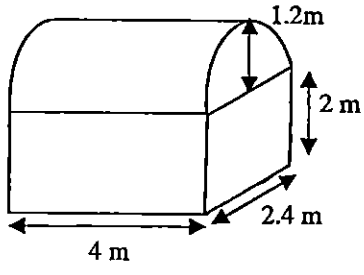


Diagram 1

(b) The tank is filled with petrol.

(i) Calculate the amount of petrol needed to fill the tank in m^3. [3]

(ii) All of the petrol from the tank will fill up an underground storage tank completely. [3]
The storage tank as shown in Diagram 2 is a prism whose cross-section is a trapezium.
The lengths of the parallel sides of the trapezium are 4 m and 3 m.
The depth of the storage tank is 3.2 m
Calculate the length of the underground tank.

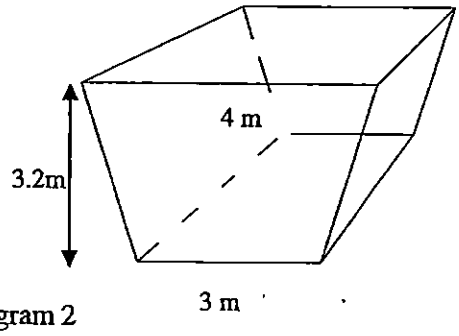


Diagram 2

8. ***Answer the whole of this question on a sheet of graph paper.***

Stevie kicks a soccer ball vertically upwards.
The height, h metres, of the ball at t seconds after it leave the ground is given by the formula $h = 24t - 4t^2$.
The table below shows some values of t and the corresponding values of h.

t	0	1	2	3	4	5
h	0	20	32	m	32	20

(a) Find the value of m. [1]

(b) Using a scale of 2 cm to represent 1 second, draw a horizontal t-axis for $0 \le t \le 6$. [3]
Using a scale of 2 cm to represent 5 metres, draw a vertical h-axis for $0 \le h \le 40$.

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

(c) Use your graph to find
(i) the greatest height of the ball above the ground, [1]
(ii) the length of time for which the ball was more than 20 metres above the ground, [2]
(iii) the time taken for the ball to hit the ground again. [1]

– END OF PAPER –

Sec 2 Express Mathematics Mid-Year Examination 2014
Paper 2 Marking Scheme

Qn No	*Working*	*Marks*
1(a)	15 carpenters => 30 knives 1 carpenter => 2 knives [M1] 8 carpenters => 2×8 = 16 knives [A1] OR Let C represent the number of carpenters and x represent the number of knives made Number of carpenters (C) is directly proportional to the number of knives made (x). $C = kx$ $15 = k(30)$ $k = 0.5$ [M1] $C = 0.5x$ $(8) = 0.5x$ $x = 16$ [A1]	M1 for 1 carpenter => 2 knives A1 for 16 M1 for $k = 0.5$ A1 for 16
1(b)	Time taken $= \frac{0.2}{4}$ = 0.05 h = 3 minutes [B1] Total distance = 2.4 km Total time taken = 12 min = 0.2 hours Average speed $= \frac{2.4}{0.2}$ [M1] = 12 km/h [A1]	B1 for 3 minutes M1 for $\frac{2.4}{0.2}$ A1 for 12 km/h
2(a)	Let the tens digit of the original number be x and its ones digit be y. Then the original number is $10x + y$, The number obtained when the digits of the original number are reversed is $10y + x$. $x + y = \frac{1}{4}(10x + y)$ $4(x + y) = 10x + y$ $4y - y = 10x - 4x$ $3y = 6x$ $y = 2x \ldots(1)$ [M1] $(10x + y) - (10y + x) = -27$	M1 for $y = 2x$

	$9x-9y=-27$ ...(2) [M1] Substitute (1) into (2), $9x-9(2x)=-27$ [M1] $-9x=-27$ $x=3$ Substitute $x=3$ into (1), $y=2(3)$ $y=6$ [A1]	M1 for $9x-9y=-27$ M1 for $9x-9(2x)=-27$ A1 for $y=6$
2(b)(i)	13^{th} term in the sequence $=38-12(4)$ $=-10$ [B1]	B1 for -10
2(b)(ii)	$\frac{n(n+1)}{2}$ [B2]	B2 for $\frac{n(n+1)}{2}$
3(a)	Breadth of the court $=\frac{50-2x}{2}$ $=25-x$ [B1]	 B1 for $25-x$
3(b)	Area of the basketball court = length × breadth $150 = x(25-x)$ $150 = 25x-x^2$ $x^2-25x+150 = 0$ [B1]	 B1 for $x^2-25x+150=0$
3(c)	$x^2-25x+150=0$ $(x-10)(x-15)=0$ [M1] $x-10=0$ or $x-15=0$ $x=10$ $x=15$ [A1]	 M1 for $(x-10)(x-15)=0$ A1 for $x=15$
3(d)	Breadth of the court $=25-(15)$ $=10$ [B1]	 B1 for 10
4(a)	$\frac{24x^2}{y}\div\frac{6x^3}{y^2} = \frac{24x^2}{y}\times\frac{y^2}{6x^3}$ [M1] $=\frac{4}{1}\times\frac{y}{x}$ $=\frac{4y}{x}$ [A1]	M1 for $\frac{24x^2}{y}\times\frac{y^2}{6x^3}$ A1 for $\frac{4y}{x}$
4(b)	$7p^2-28 = 7(p^2-4)$ [M1] $= 7(p+2)(p-2)$ [A1]	M1 for $7(p^2-4)$

		A1 for $7(p+2)(p-2)$
4(c)	$\frac{7p^2-28}{p^2+2p} = \frac{7(p-2)(p+2)}{p(p+2)}$ [M1] $= \frac{7(p-2)}{p}$ $= 7-\frac{2}{p}$ [A1]	M1 for $\frac{7(p-2)(p+2)}{p(p+2)}$ A1 for $7-\frac{2}{p}$
5(a)	$2x-25 \geq 18+8x$ or $2x-25 \geq 18+8x$ $-25-18 \geq 8x-2x$ $-6x \geq 43$ [M1] $-43 \geq 6x$ [M1] $x \leq \frac{-43}{6}$ [A1] $\frac{-43}{6} \geq x$ [A1]	M1 for $-43 \geq 6x$ or $-6x \geq 43$ A1 for $\frac{-43}{6} \geq x$ or $x \leq \frac{-43}{6}$
5(b)	$x \leq \frac{-43}{6}$ $x \leq -7.1666$ greatest odd integer value of $x = -9$ [B1]	B1 for $x = -9$
5(c)	Let the number of trips be x, $25x > 243$ [M1] $x > \frac{243}{25}$ $x > 9.72$ minimum value of $x = 10$ [A1]	M1 for $25x > 243$ A1 for $x = 10$
6(a)	$\angle ABC = 180° - \angle BCD$ $= 180° - 60°$ $= 120°$ [B1]	B1 for $\angle ABC = 120°$
6(b)	$\angle DAE = \angle BAD - 18°$ $= 60° - 18°$ $= 42°$ [B1]	B1 for $\angle DAE = 42°$
6(c)	Area of parallelogram $ABCD = 15.2 \times 9$ $= 136.8$	M1 for $25x > 243$ A1 for 136.8

7(a)	Surface Area of the cuboid $A = 2(2.4\times2)+2(4\times2)+(4\times2.4)$ $A = 9.6+8+9.6$ $A = 27.2$ Surface Area of the half cylinder $A = \frac{1}{2}(2.4\times\pi\times4)+\pi(1.2)^2$ $A = 6.24\pi$ Total Surface area = 27.2 + 19.604 = 46.804 = 46.8 (to 3 s.f)	[M1] [M2] [A1]	M1 for $A = 2(2.4\times2)+2(4\times2)+(4\times2.4)$ M1 for $A = \frac{1}{2}(2.4\times\pi\times4)$ M1 for $A = \pi(1.2)^2$ A1 for 46.8
7(b)(i)	Volume of the cuboid $V = 2\times2.4\times4$ $V = 19.2$ Volume of the half cylinder $V = \frac{1}{2}\pi(1.2)^2\times4$ $V = 2.88\pi$ Volume of the tank $V = 19.2+2.88\pi$ $V = 28.2$ (to 3 s.f) Or Volume of the tank $V = \left[(2.4\times2)+\frac{1}{2}\pi(1.2)^2\right]\times4$ $V = 28.248$ $V = 28.2$ (to 3 s.f)	[M1] [M1] [A1] [M2] [A1]	M1 for $V = 2\times2.4\times4$ M1 for $V = \frac{1}{2}\pi(1.2)^2\times4$ A1 for 28.2 M2 for $V = \left[(2.4\times2)+\frac{1}{2}\pi(1.2)^2\right]\times4$ A1 for 28.2
7(b)(ii)	Area of trapezium $A = \frac{1}{2}(3+4)\times3.2 = 11.2$ $h = 28.248\div11.2$ = 2.52 m	[M1] [M1] [A1]	M1 for $A = \frac{1}{2}(3+4)\times3.2$ M1 for $h = 28.248\div11.2$ A1 for 46.8
8(a)	When $t = 3$, $h = 24(3)-4(3)^2$ $h = 36$		B1 for $m = 36$
7(b)			
7(c)(i)	$t = 3$ and $h = 36$		B1 for both correct answer
7(c)(ii)	Length of time = 5 − 1		B2

	$= 4$ sec	
7(c)(iii)	$t = 6$	B1