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**BEATTYSECONDARY SCHOOL
MID-YEAR EXAMINATION 2014**

SUBJECT : Mathematics

LEVEL : Sec 2 Express

PAPER : 1

DURATION : 1 hour 15 minutes

SETTER : Mrs Rose Ang

DATE :16May 2014

CLASS :	NAME :	REG NO :
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The total number of marks for this paper is 50.

For Examiner's Use
50

This paper consists of 9 printed pages (including this cover page)

[Turn over

For
Examiner's
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For
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Use

1 Expand and simplify

(a) $(2x-5)(x^2+5)$

(b) $3(x-3y)^2$

Answer : (a) _____ [1]

(b) _____ [2]

2 Factorise completely.

(a) $3x^2+7x-6$

(b) $162-128y^2$

(c) $1-a^2-ab-b$

Answer : (a) _____ [2]

(b) _____ [2]

(c) _____ [2]

For
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Use

3 Simplify each of the following.

For
Examiner's
Use

(a) $\frac{5a^2b \times 6(ab)^2}{15ab^2}$

(b) $\frac{3x+9}{x+1} \div \frac{(x+3)^2}{x^2+4x+3}$

(c) $\frac{1}{x-1} + \frac{x-1}{1-x^2}$

Answer : (a) _____ [1]

(b) _____ [2]

(c) _____ [3]

[Turn over

For
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Use

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Examiner's
Use

4 Solve each of the following equations.

(a) $(2x+1)(x-3)=0$

(b) $(x+2)^2-2x=7$

Answer : (a) _____ [1]

(b) _____ [3]

5 Solve the simultaneous equations.

$$2x+3y=-2.5$$

$$3x-4y+25=0$$

Answer : $x =$ _____ , $y =$ _____ [3]

For
Examiner's
Use

For
Examiner's
Use

6 (a) Make s the subject of the formula $\frac{1}{r} + \frac{1}{s} = \frac{1}{t}$.

(b) Given that $\sqrt{a^2 + b} = c + 1$, —

(i) express a in terms of b and c .

(ii) Hence, find the exact value of a when $b = -5$ and $c = 3$.

Answer : (a) _____ [3]

(bi) _____ [2]

(bii) _____ [1]

[Turn over

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Use

For
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Use

7 A map is drawn to a scale of 1 : 5000.

- (a) A rectangular car park has a length of 10.5 cm on the map. Find the actual length of the car park in metres.
- (b) A circular pond has an actual area of $1\,500\pi$ square metres. Find the area of this circular pond on the map, giving your answer in terms of π .

Answer : (a) _____ m [2]

(b) _____ cm^2 [3]

8 Rachel threw a ball upwards from the ground.

Given that the height of the ball, h metres, from the ground after t seconds is given by the equation $h = 30t - 6t^2$, find the time taken for the ball to hit the ground.

Answer : _____ s [3]

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9 p is inversely proportional to the cube of q .

- (a) Given that when $p = 5$, $q = 2$, express p in an equation in terms of q .
(b) It is known that $p = \theta$ for a particular value of q .

Find the value of p in terms of θ , when this value of q is halved.

Answer: (a) _____ [2]

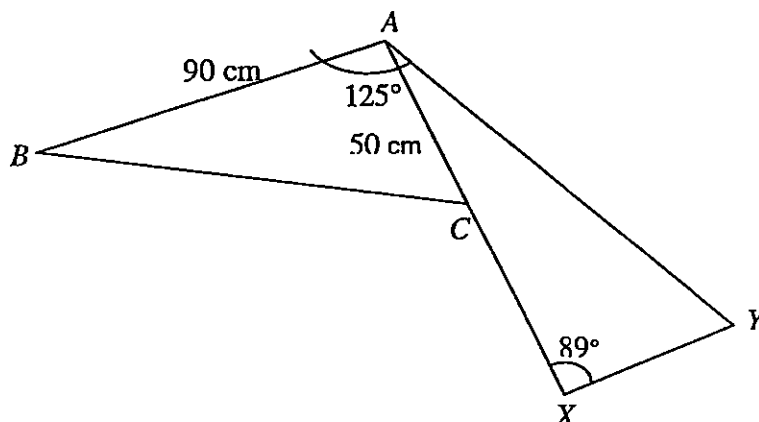
(b) _____ [2]

[Turn over

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- 10 In the figure below, $\triangle ABC \cong \triangle XAY$, $AB = 90$ cm, $AC = 50$ cm, $\angle AXY = 89^\circ$ and $\angle BAY = 125^\circ$



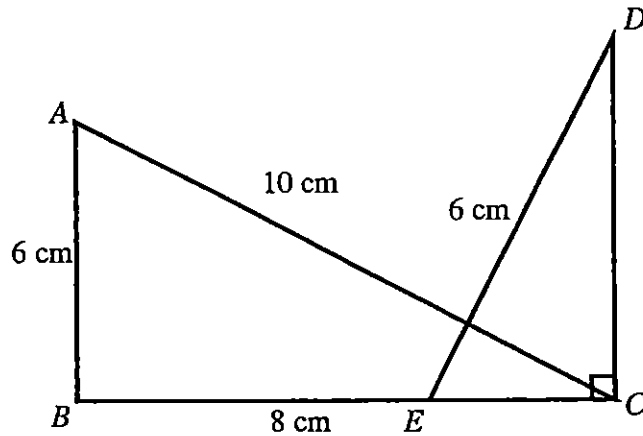
- (a) Write down the length of XY .
 (b) Find $\angle XAY$, stating your reason clearly.
 (c) Find $AC : CX$.

Answer : (a) _____ cm [1]
 (b) _____ [2]
 (c) _____ [2]

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- 11 In the figure below, $\triangle BAC$ is similar to $\triangle CED$.
Given that $AC = 10$ cm, $DE = 6$ cm, $AB = 6$ cm and $\angle DCE = 90^\circ$. Find



- (a) Find $\angle ABC$.
(b) Calculate
(i) the length of EC ,
(ii) the area of $\triangle CED$.

Answer : (a) _____° [1]

(bi) _____ cm [2]

(bii) _____ cm² [2]

~ End of Paper ~

Answer Key

1a	$2x^3 - 5x^2 + 10x - 25$	1b	$3x^2 - 18xy + 27y^2$		
2a	$(3x - 2)(x + 3)$	2b	$2(9 + 8y)(9 - 8y)$	2c	$(a + 1)(1 - a - b)$
3a	$2a^3b$	3b	3	3c	$\frac{2}{(x + 1)(x - 1)}$
4a	$x = -\frac{1}{2}$ or $x = 3$	4b	$x = -3$ or $x = 1$		
5	$x = -5, y = 2.5$				
6a	$s = \frac{rt}{r - t}$	6bi	$a = \pm\sqrt{(c + 1)^2 - b}$	6bii	$a = \pm\sqrt{21}$
7a	525 m	7b	$\frac{3\pi}{5} \text{ cm}^2$		
8	$t = 5$	9a	$p = \frac{40}{q^3}$	9b	$p = 8\theta$
10a	50 cm	10b	$\angle XAY = 125^\circ - 89^\circ = 36^\circ$	10c	5 : 4
11a	90°	11bi	3.6 cm	11bii	8.64 cm^2



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Marking Scheme

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(b) $3(x-3y)^2$

(a) $(2x-5)(x^2+5)$
 $= 2x^3 - 5x^2 + 10x - 25$ [B1]

(b) $3(x-3y)^2$
 $= 3(x^2 - 6xy + 9y^2)$ or $(3x-9y)(x-3y)$ [M1]
 $= 3x^2 - 18xy + 27y^2$ [A1]

Answer : (a) _____ [1]

(b) _____ [2]

2 Factorise completely.

(a) $3x^2 + 7x - 6$

(b) $162 - 128y^2$

(c) $1 - a^2 - ab - b$

(a) $3x^2 + 7x - 6$
 $= (3x-2)(x+3)$ [M1, A1] or [A2]

(b) $162 - 128y^2$
 $= 2(81 - 64y^2)$ [M1]
 $= 2(9+8y)(9-8y)$ [A1]

(c) $1 - a^2 - ab - b$
 $= (1+a)(1-a) - b(a+1)$ [M1]
 $= (a+1)(1-a-b)$ [A1]

Answer : (a) _____ [2]

(b) _____ [2]

(c) _____ [2]

For
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3 Simplify each of the following.

(a) $\frac{5a^2b \times 6(ab)^2}{15ab^2}$

(b) $\frac{3x+9}{x+1} \div \frac{(x+3)^2}{x^2+4x+3}$

(c) $\frac{1}{x-1} + \frac{x-1}{1-x^2}$

(a) $\frac{5a^2b \times 6(ab)^2}{15ab^2} = 2a^3b$ [B1]

(b) $\frac{3x+9}{x+1} \div \frac{(x+3)^2}{x^2+4x+3}$
 $= \frac{3(x+3)}{x+1} \times \frac{(x+3)(x+1)}{(x+3)^2}$ [M1]
 $= 3$ [A1]

(c) $\frac{1}{x-1} + \frac{x-1}{(1+x)(1-x)}$
 $= \frac{1}{x-1} - \frac{x-1}{(1+x)(x-1)}$ [M1- change of sign]
 $= \frac{x+1-x+1}{(x+1)(x-1)}$ [M1-common denominator]
 $= \frac{2}{(x+1)(x-1)}$ [A1]

Answer : (a) _____ [1]

(b) _____ [2]

(c) _____ [3]

4 Solve each of the following equations.

(a) $(2x+1)(x-3)=0$

(b) $(x+2)^2 - 2x = 7$

(a) $x = -\frac{1}{2}$ or $x = 3$ [B1]

(b) $(x+2)^2 - 2x = 7$
 $x^2 + 2x - 3 = 0$ [M1]
 $(x+3)(x-1) = 0$ [M1]
 $x = -3$ or $x = 1$ [A1]

Answer : (a) _____ [1]

(b) _____ [3]

5 Solve the simultaneous equations.

$$2x + 3y = -2.5$$

$$3x - 4y + 25 = 0$$

$$2x + 3y = -2.5 \text{ ----- (1)}$$

$$3x - 4y = -25 \text{ ----- (2)}$$

$$(1) \times 3, \quad 6x + 9y = -7.5 \text{ ----- (3)}$$

$$(2) \times 2, \quad 6x - 8y = -50 \text{ ----- (4)}$$

$$(3) - (4), \quad 17y = 42.5$$

$$y = 2.5$$

Sub $y = 2.5$ into (1),

$$2x + 3(2.5) = -2.5$$

$$x = -5$$

Answer : $x =$ _____ , $y =$ _____ [3]

For
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6 (a) Make s the subject of the formula $\frac{1}{r} + \frac{1}{s} = \frac{1}{t}$.

(b) Given that $\sqrt{a^2 + b} = c + 1$,

(i) express a in terms of b and c .

(ii) Hence, find the exact value of a when $b = -5$ and $c = 3$.

(a) $\frac{1}{r} + \frac{1}{s} = \frac{1}{t}$
 $\frac{1}{s} = \frac{1}{t} - \frac{1}{r}$ [M1]
 $\frac{1}{s} = \frac{r-t}{rt}$ [M1]
 $s = \frac{rt}{r-t}$ [A1]

(b) $\sqrt{a^2 + b} = c + 1$
 (i) $a^2 + b = (c + 1)^2$ [M1]
 $a^2 = (c + 1)^2 - b$

$a = \pm\sqrt{(c + 1)^2 - b}$ [A1]

(ii) $a = \pm\sqrt{(3 + 1)^2 + 5} = \pm\sqrt{21}$ [B1]

Answer : (a) _____ [3]

(bi) _____ [2]

(bii) _____ [1]

For
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7 A map is drawn to a scale of 1 : 5000.

- (a) A rectangular car park has a length of 10.5 cm on the map. Find the actual length of the car park in metres.
- (b) A circular pond has an actual area of $1\,500\pi$ square metres. Find the area of this circular pond on the map, giving your answer in terms of π .

(a) 1 cm ----- 5 000 cm
 1 cm ----- 50 m [M1]
 10.5 cm ----- 525 m [A1]

(b) 1 cm^2 ----- $2\,500\text{ m}^2$ [M1]

$$\frac{\pi \times 1500}{2500} \text{ cm}^2 \text{ ----- } 1\,500\pi \text{ m}^2 \text{ [M1]}$$

$$= \frac{3\pi}{5} \text{ cm}^2 \quad \text{[A1]}$$

Answer : (a) _____ m [2]

(b) _____ cm^2 [3]

- 8 Rachel threw a ball upwards from the ground.
 Given that the height of the ball, h metres, from the ground after t seconds is given by the equation $h = 30t - 6t^2$, find the time taken for the ball to hit the ground.

$$h = 6t(5 - t) = 0 \text{ [M1]}$$

$$t = 0 \text{ (rej) or } t = 5 \text{ [M1]}$$

$$t = 5 \text{ [A1]}$$

Answer : _____ s [3]

9 p is inversely proportional to the cube of q .

- (a) Given that when $p = 5$, $q = 2$, express p in an equation in terms of q .
 (b) It is known that $p = \theta$ for a particular value of q . Find the value of p in terms of θ , when this value of q is halved.

(a) $p = \frac{k}{q^3}$

$$5 = \frac{k}{2^3} \Rightarrow k = 40 \quad [\text{M1}]$$

$$p = \frac{40}{q^3} \quad [\text{A1}]$$

(b) When $q = a$, $p = \theta \Rightarrow \theta = \frac{40}{a^3}$

$$\text{When } q = \frac{1}{2}a, \quad p = \frac{40}{\left(\frac{1}{2}a\right)^3} \quad [\text{M1}]$$

$$p = 8\left(\frac{40}{a^3}\right) = 8\theta \quad [\text{A1}]$$

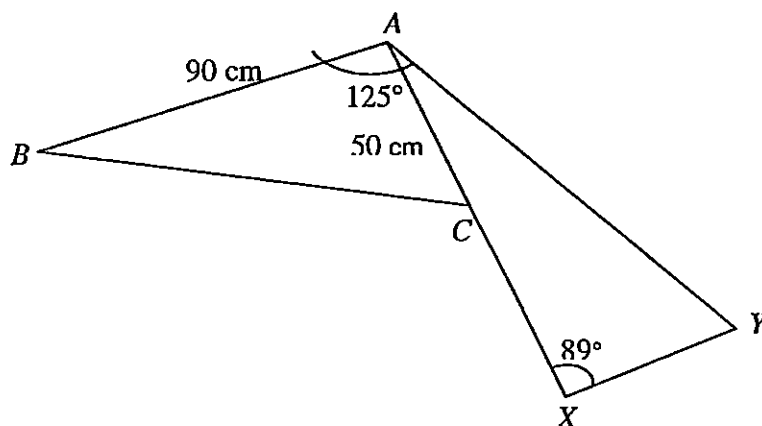
Answer : (a) _____ [2]

(b) _____ [2]

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- 10 In the figure below, $\triangle ABC \equiv \triangle XAY$, $AB = 90$ cm, $AC = 50$ cm, $\angle AXY = 89^\circ$ and $\angle BAY = 125^\circ$



- (a) Write down the length of XY .
 (b) Find $\angle XAY$, stating your reason clearly.
 (c) Find $AC : CX$.

(a) $XY = 50$ cm [B1]

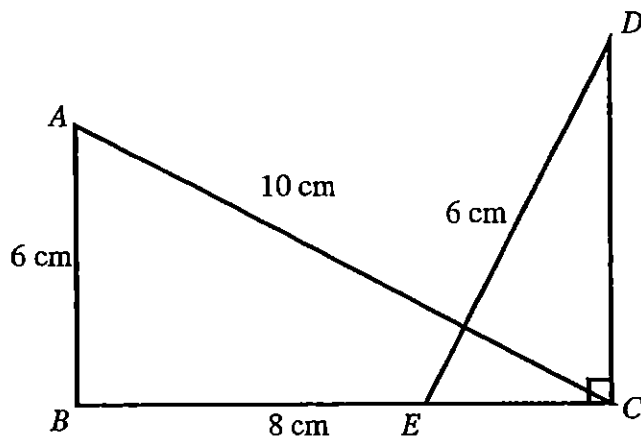
(b) $\angle BAC = \angle AXY = 89^\circ$ [M1]
 $\angle XAY = 125^\circ - 89^\circ = 36^\circ$ [A1]

(c) $AX = AB = 90$ cm [M1]
 $CX = 90 - 50 = 40$ cm
 $AC : CX = 5 : 4$ [A1]

Answer : (a) _____ cm [1]
 (b) _____ [2]
 (c) _____ [2]

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- 11 In the figure below, $\triangle BAC$ is similar to $\triangle CED$.
Given that $AC = 10$ cm, $DE = 6$ cm, $AB = 6$ cm and $\angle DCE = 90^\circ$. Find



- (a) Find $\angle ABC$.
(b) Calculate
(i) the length of EC ,
(ii) the area of $\triangle CED$.

(a) $\angle ABC = 90^\circ$ [B1]

(b) (i) $\frac{EC}{AB} = \frac{DE}{AC}$
 $\frac{EC}{6} = \frac{6}{10}$ [M1]
 $EC = 3.6$ cm [A1]

(ii) $\frac{DC}{8} = \frac{6}{10}$ [M1]
 $DC = 4.8$ cm

Area of $\triangle CED = \frac{1}{2} \times 3.6 \times 4.8 = 8.64$ cm² [A1]

Answer : (a) _____ ° [1]

(b) _____ cm [2]

(bii) _____ cm² [2]

~ End of Paper ~



**BEATTY SECONDARY SCHOOL
MID-YEAREXAMINATION 2014**

SUBJECT : Mathematics

LEVEL : Sec 2Express

PAPER : 2

DURATION : 1 hour 30 minutes

SETTER : MrsKajen

DATE : 19May 2014

CLASS :	NAME :	REG NO :
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1. The area of a reservoir is 180000 m^2 . It is represented on a map by an area of 2 cm^2 .
 - (a) Express the scale in the form $1 : n$. [2]
 - (b) Given that the shoreline of the reservoir is 5.4 km . What is the shoreline on the map? [2]

2. (a) Two quantities, y and x^2 , are in inverse proportion.
 If the difference in the values of y when $x = 5$ and when $x = 10$ is 1.2 , find
 - (i) an equation connecting x and y , [2]
 - (ii) the value of y when $x = -2$. [1]
- (b) Two quantities, p and $\sqrt{q}$, are in direct proportion. When q is increased by $h\%$, the percentage increase in p is 200% . Find the value of h . [2]

3. Expand and simplify the following.
 - (a) $(3x - 5)(3x + 5)$ [1]
 - (b) $(3 - y)(7 + 4y)$ [2]

4. Factorise the following completely.
 - (a) $12x^3y - 18x^2y^2 + 6xy^3$ [2]
 - (b) $16 - (c + 2d)^2$ [2]

5. (a) Factorise $2x^2 + 13x + 15$ [1]
- (b) Hence, write down the factors of 21315 . [2]

6. Given $y = \frac{6x - 2z}{3z - x}$
 - (a) If $z = -3$ and $y = 2$, find x . [2]
 - (b) Express z in terms of y and x . [2]

7. Simplify the following.

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

(b) $\left[\frac{x-6}{x^2-x-6} - 1 \right] \div \frac{x^2}{4-x^2}$ [3]

8. It is given that $x = 5$ is a root of the equation $4x^2 + kx - 15 = 0$, where k is a constant. Find,

(a) the value of k , [2]

(b) the other root of the equation. [2]

9. The area of a rectangle is four times the area of a square of side $(x + 1)$ cm. The length and breadth of the rectangle are $(3x + 5)$ cm and $(3x - 1)$ cm respectively.

(a) Form an equation in x and show that it reduces to $5x^2 + 4x - 9 = 0$. [2]

(b) Solve the equation. [2]

(c) Hence find the area of the rectangle. [2]

10. The radius of a small circle is $(p - 2q)$ cm and the radius of a big circle is $(5p - 12q)$ cm. The radius of the big circle is twice the radius of the small circle.

(a) Write down and simplify a linear equation connecting p and q . [1]

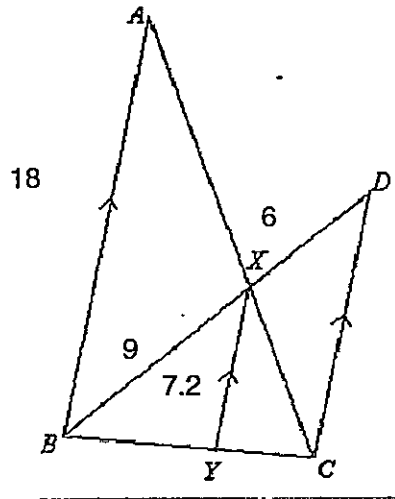
(b) If the sum of the circumference of the two circles is 16π cm. [2]

Write down and simplify another linear equation connecting p and q .

(c) (i) Find the values of p and q . [3]

(ii) Hence, find the radii of the small circle. [1]

11. In the diagram below, AB , DC and XY are parallel to each other. AC and BD meet at X . It is given that triangle ABX is similar to triangle CDX .



Given that $AB = 18$ cm, $DX = 6$ cm, $XB = 9$ cm and $XY = 7.2$ cm, find

(a) the length of CD , [2]

(b) $\frac{\text{Area of } \triangle CXY}{\text{Area of trapezium } XABY}$ [2]

~~~End of Paper~~~

**Answers**

|    |                                |     |                                            |
|----|--------------------------------|-----|--------------------------------------------|
| 1a | 30 000 cm                      | 6a  | -3                                         |
| 1b | 18 cm                          | 6b  | $z = \frac{x(6+y)}{3y+2}$                  |
| 2a | (i) $y = \frac{40}{x^2}$       | 7a  | $\frac{x-6}{2(2x+1)(x-2)}$                 |
|    | (ii) 10                        | 7b  | $= \left[ \frac{(2-x)^2}{x(x-3)} \right]$  |
| 2b | 800                            |     |                                            |
|    |                                | 8a  | $k = -17$                                  |
| 3a | $9x^2 - 25$                    | 8b  | $x = -\frac{3}{4}$                         |
| 3b | $21 + 5y - 4y^2$               |     |                                            |
|    |                                | 9b  | $x = -\frac{9}{5} \text{ or } x = 1$       |
| 4a | $6xy(2x-y)(x-y)$               | 9c  | $16 \text{ cm}^2$                          |
| 4b | $[4 - (c - 2d)][4 + (c - 2d)]$ |     |                                            |
|    |                                | 10a | $3p - 8q = 0$                              |
| 5a | $(2x+3)(x+5)$                  | 10b | $3p - 7q = 4 \text{ (2)}$                  |
| 5b | $21315 = (203)(105)$           | 10c | (i) $p = 10\frac{2}{3} \text{ and } q = 4$ |
|    |                                |     | (ii) $2\frac{2}{3}$                        |
|    |                                | 11a | 12cm                                       |
|    |                                | 11b | $\frac{4}{21}$                             |



**BEATTY SECONDARY SCHOOL  
MID-YEAREXAMINATION 2014**

**SUBJECT : Mathematics**

**LEVEL : Sec 2Express**

**PAPER : 2**

**DURATION : 1 hour 30 minutes**

**SETTER : MrsKajen**

**DATE : 19May 2014**

|                |               |                 |
|----------------|---------------|-----------------|
| <b>CLASS :</b> | <b>NAME :</b> | <b>REG NO :</b> |
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|    |                                                                                                               |                                                                                                       |
|----|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| 1. | The area of a reservoir is $180\,000\text{ m}^2$ . It is represented on a map by an area of $2\text{ cm}^2$ . |                                                                                                       |
|    | (a)                                                                                                           | Express the scale in the form $1 : n$ . [2]                                                           |
|    | (b)                                                                                                           | Given that the shoreline of the reservoir is $5.4\text{ km}$ . What is the shoreline on the map ? [2] |

|  |     |                                                                                                                                                                        |
|--|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | (a) | $2\text{ cm}^2 = 180\,000\text{ m}^2$<br>$1\text{ cm}^2 = 90\,000\text{ m}^2$<br>$1\text{ cm} = \sqrt{90\,000}$ [M1]<br>$= 300\text{ m}$<br>$= 30\,000\text{ cm}$ [A1] |
|  | (b) | Shoreline on map $= \frac{5.4 \times 1000 \times 100}{30\,000}$ [M1]<br>$= 18\text{ cm}$ [A1]                                                                          |

|    |      |                                                                                                                                                                                                                                                                   |     |
|----|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 2. | (a)  | Two quantities, $y$ and $x^2$ , are in inverse proportion.<br>If the difference in the values of $y$ when $x = 5$ and when $x = 10$ is $1.2$ , find                                                                                                               |     |
|    | (i)  | an equation connecting $x$ and $y$ ,<br>$y = \frac{k}{x^2}$<br>$\frac{k}{5^2} - \frac{k}{10^2} = 1.2$ [M1]<br>$\frac{k}{25} - \frac{k}{100} = 1.2$<br>$\frac{4k - k}{100} = 1.2$<br>$\frac{3k}{100} = 1.2$<br>$3k = 120$<br>$k = 40$<br>$y = \frac{40}{x^2}$ [A1] | [2] |
|    | (ii) | the value of $y$ when $x = -2$ .<br>$y = \frac{40}{(-2)^2}$<br>$= 10$ [B1]                                                                                                                                                                                        | [1] |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  | <p>(b) Two quantities, <math>p</math> and <math>\sqrt{q}</math> are in direct proportion. When <math>q</math> is increased by <math>h\%</math>, the percentage increase in <math>p</math> is 200%. Find the value of <math>h</math>. [2]</p> <p><math>p = k\sqrt{q}</math></p> <p><math>3p = k\sqrt{\frac{100+h}{100}}q</math> [M1]</p> <p><math>3p = k\sqrt{q}\sqrt{\frac{100+h}{100}}</math></p> <p><math>3p = p\sqrt{\frac{100+h}{100}}</math></p> <p><math>3 = \sqrt{\frac{100+h}{100}}</math></p> <p><math>9 = \frac{100+h}{100}</math></p> <p><math>900 = 100 + h</math></p> <p><math>h = 900 - 100</math></p> <p><math>= 800</math> [A1]</p> |  |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

|    |                                                                                                                                       |  |
|----|---------------------------------------------------------------------------------------------------------------------------------------|--|
| 3. | Expand and simplify the following.                                                                                                    |  |
|    | <p>(a) <math>(3x - 5)(3x + 5)</math> [1]</p> <p><math>= 9x^2 - 25</math> [B1]</p>                                                     |  |
|    | <p>(b) <math>(3 - y)(7 + 4y)</math> [2]</p> <p><math>= 21 + 12y - 7y - 4y^2</math> [M1]</p> <p><math>= 21 + 5y - 4y^2</math> [A1]</p> |  |

|    |                                                                                                                                                      |  |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 4. | Factorise the following completely.                                                                                                                  |  |
|    | <p>(a) <math>12x^3y - 18x^2y^2 + 6xy^3</math> [2]</p> <p><math>= 6xy(2x^2 - 3xy + y^2)</math> [M1]</p> <p><math>= 6xy(2x - y)(x - y)</math> [A1]</p> |  |
|    | <p>(b) <math>16 - (c - 2d)^2</math> [2]</p> <p><math>= 4^2 - (c - 2d)^2</math> [M1]</p>                                                              |  |

|  |  |                                       |  |
|--|--|---------------------------------------|--|
|  |  | $= [4 - (c - 2d)][4 + (c - 2d)]$ [A1] |  |
|--|--|---------------------------------------|--|

|    |     |                                                                                                                                          |     |
|----|-----|------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 5. | (a) | Factorise $2x^2 + 13x + 15$<br>$= (2x + 3)(x + 5)$ [B1]                                                                                  | [1] |
|    | (b) | Hence, write down the factors of 21315.<br>$21315 = 2(10\ 000) + 13(100) + 15$ [M1]<br>$= [2(100) + 3][100 + 5]$<br>$= (203) (105)$ [A1] | [2] |

|    |                                    |                                                                                                                                                                                                                                                                                                                                                                   |     |
|----|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 6. | Given $y = \frac{6x - 2z}{3z - x}$ |                                                                                                                                                                                                                                                                                                                                                                   |     |
|    | (a)                                | <p>If <math>z = -3</math> and <math>y = 2</math>, find <math>x</math>.</p> $y = \frac{6x - 2z}{3z - x}$ $2 = \frac{6x - 2(-3)}{3(-3) - x} \quad [\text{M1}]$ $2 = \frac{6x + 6}{-9 - x}$ $2(-9 - x) = 6x + 6$ $-18 - 6 = 6x + 2x \quad \left. \begin{array}{l} \\ \end{array} \right\} -18 - 2x = 6x + 6$ $-24 = 8x$ $x = \frac{-24}{8}$ $= -3 \quad [\text{A1}]$ | [2] |
|    | (b)                                | Express $z$ in terms of $y$ and $x$ .<br>$y = \frac{6x - 2z}{3z - x}$                                                                                                                                                                                                                                                                                             | [2] |

|  |                                                                                                                                        |  |
|--|----------------------------------------------------------------------------------------------------------------------------------------|--|
|  | $y(3z - x) = 6x - 2z$<br>$3yz - xy = 6x - 2z$ [M1]<br>$3yz + 2z = 6x + xy$<br>$z(3y + 2) = x(6 + y)$<br>$z = \frac{x(6+y)}{3y+2}$ [A1] |  |
|--|----------------------------------------------------------------------------------------------------------------------------------------|--|

|     |                                                                                                                                                                                                                                                                                                              |     |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 7.  | Simplify the following.                                                                                                                                                                                                                                                                                      |     |
| (a) | $\frac{3}{4x+2} - \frac{x}{2x^2-3x-2}$ $= \frac{3}{2(2x+1)} - \frac{x}{(2x+1)(x-2)}$ [M1] $= \frac{3(x-2) - 2x}{2(2x+1)(x-2)}$ [M1] $= \frac{3x - 6 - 2x}{2(2x+1)(x-2)}$ $= \frac{x-6}{2(2x+1)(x-2)}$ [A1]                                                                                                   | [3] |
| (b) | $= \left[ \frac{x-6}{(x-3)(x+2)} - 1 \right] \div \frac{x^2}{4-x^2}$ [M1] $= \left[ \frac{x-6-(x^2-x-6)}{(x-3)(x+2)} \right] \times \frac{4-x^2}{x^2}$ $= \left[ \frac{x-6-x^2+x+6}{(x-3)(x+2)} \right] \times \frac{(2+x)(2-x)}{x^2}$ [M1] $= \left[ \frac{2x-x^2}{(x-3)} \right] \times \frac{(2-x)}{x^2}$ | [3] |

|  |  |                                                                                                             |  |
|--|--|-------------------------------------------------------------------------------------------------------------|--|
|  |  | $= \left[ \frac{x(2-x)}{(x-3)} \right] \times \frac{2-x}{x^2} = \left[ \frac{(2-x)^2}{x(x-3)} \right]$ [A1] |  |
|--|--|-------------------------------------------------------------------------------------------------------------|--|

|     |                                                                                                                                           |  |     |
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| 8.  | It is given that $x = 5$ is a root of the equation $4x^2 + kx - 15 = 0$ , where $k$ is a constant. Find,                                  |  |     |
| (a) | the value of $k$ ,                                                                                                                        |  | [2] |
|     | $4x^2 + kx - 15 = 0$<br>$4(5^2) + k(5) - 15 = 0$ [M1]<br>$100 - 15 + 5k = 0$<br>$85 + 5k = 0$<br>$5k = -85$<br>$k = -17$ [A1]             |  |     |
| (b) | the other root of the equation.                                                                                                           |  | [2] |
|     | $4x^2 - 17x - 15 = 0$<br>$(4x + 3)(x - 5) = 0$<br>$(4x + 3) = 0$ or $(x - 5) = 0$ [M1]<br>$4x = -3$ or $x = 5$<br>$x = -\frac{3}{4}$ [A1] |  |     |

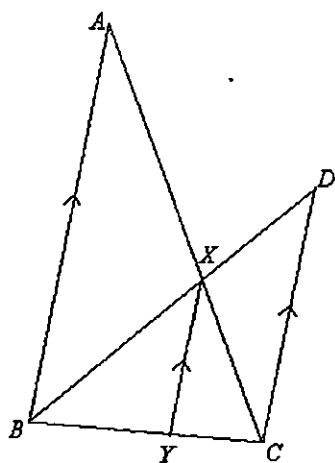
|     |                                                                                                                                                                            |  |     |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|
| 9.  | The area of a rectangle is four times the area of a square of side $(x + 1)$ cm. The length and breadth of the rectangle are $(3x + 5)$ cm and $(3x - 1)$ cm respectively. |  |     |
| (a) | Form an equation in $x$ and show that it reduces to $5x^2 + 4x - 9 = 0$                                                                                                    |  | [2] |
|     | $4(x + 1)^2 = (3x + 5)(3x - 1)$ [M1]<br>$4(x^2 + 2x + 1) = 9x^2 - 3x + 15x - 5$<br>$4x^2 + 8x + 4 = 9x^2 + 12x - 5$ [M1]<br>$5x^2 + 4x - 9 = 0$ [proven]                   |  |     |

|  |                                                                                                                                                                                                                                                        |     |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|  | <p>(b) Solve the equation and find the area of the rectangle</p> $5x^2 + 4x - 9 = 0$ $(5x + 9)(x - 1) = 0 \quad [\text{M1}]$ $(5x + 9) = 0 \text{ or } (x - 1) = 0$ $5x = -9 \text{ or } x = 1$ $x = -\frac{9}{5} \text{ or } x = 1 \quad [\text{A1}]$ | [2] |
|  | <p>(c) Find the area of the rectangle.</p> $\text{Area of rectangle} = 4(1 + 1)^2 \quad [\text{M1}]$ $= 16 \text{ cm}^2 \quad [\text{A1}]$                                                                                                             | [2] |

|     |                                                                                                                                                                                                                                                                                                                                                                                   |     |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 10. | The radius of a small circle is $(p - 2q)$ cm and the radius of a big circle is $(5p - 12q)$ cm. The radius of the big circle is twice the radius of the small circle.                                                                                                                                                                                                            |     |
|     | <p>(a) Write down and simplify a linear equation connecting <math>p</math> and <math>q</math>.</p> $2(p - 2q) = 5p - 12q$ $2p - 4q = 5p - 12q$ $3p - 8q = 0 \quad (1) \quad [\text{A1}]$                                                                                                                                                                                          | [1] |
|     | <p>(b) If the sum of the circumference of the two circle is <math>16\pi</math> cm.</p> <p>Write down the pair of simultaneous linear equations connecting <math>p</math> and <math>q</math>.</p> $2\pi(p - 2q) + 2\pi(5p - 12q) = 16\pi$ $2\pi[(p - 2q) + (5p - 12q)] = 16\pi \quad [\text{M1}]$ $p - 2q + 5p - 12q = 8$ $6p - 14q = 8$ $3p - 7q = 4 \quad (2) \quad [\text{A1}]$ | [2] |
|     | <p>(c) (i) Find the values of <math>p</math> and <math>q</math>.</p> $\text{Eqn (1)} - \text{Eqn (2)}$ $-8q - (-7q) = 0 - 4 \quad [\text{M1}]$                                                                                                                                                                                                                                    | [3] |

|  |      |                                                                                                                                                                            |     |
|--|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|  |      | $-q = -4$<br><br>$q = 4$<br><br>Substitute $q = 4$ into equation 1 [M1]<br>$3p - 8(4) = 0$<br>$3p - 32 = 0$<br>$3p = 32$<br>$p = \frac{32}{3}$<br>$p = 10\frac{2}{3}$ [A1] |     |
|  | (ii) | Hence, find the radii of the small circle.<br>Radius of small circle<br>$= p - 2q$<br>$= 10\frac{2}{3} - 2(4)$<br>$= 2\frac{2}{3}$ [B1]                                    | [1] |

11. In the diagram,  $AB$ ,  $DC$  and  $XY$  are parallel to each other.  $AC$  and  $BD$  meet at  $X$ . It is given that  $\triangle ABX$  is similar to  $\triangle CDX$ .



Given that  $AB = 18$  cm,  $DX = 6$  cm,  $XB = 9$  cm and  $XY = 7.2$  cm, find

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|  | <p>(a) the length of <math>CD</math>,</p> $\frac{AB}{CD} = \frac{BX}{DX}$ $\frac{18}{CD} = \frac{9}{6} \text{ [M1]}$ $18 \times 6 = 9 \times CD$ $CD = 12 \text{ [A1]}$                                                                                                                                                                                                                                                                                                                    | [2] |
|  | <p>(b)</p> $\frac{\text{Area of } \triangle CXY}{\text{Area of trapezium } XABY}$ $= \frac{7.2^2}{18^2 - 7.2^2} \text{ [M1]}$ $= \frac{4}{21} \text{ [A1]}$ <p>Or</p> $\frac{\text{Area of } \triangle CXY}{\text{Area of } \triangle CAB} = \left(\frac{7.2}{18}\right)^2$ $\frac{\text{Area of } \triangle CXY}{\text{Area of } \triangle CAB} = \left(\frac{4}{25}\right) \text{ [M1]}$ $\frac{\text{Area of } \triangle CXY}{\text{Area of } XABY} = \frac{4}{25 \div 4} \text{ [A1]}$ | [2] |

~~~End of Paper~~~