ZHONGHUA SECONDARY SCHOOL
MID YEAR EXAMINATION 2012

Name of Pupil	:	_____ ( )
Class	:	1E ___
Subject / Code	:	MATHEMATICS / 4016
Level	:	Sec 1 Express
Date	:	9 May 2012
Duration	:	2 hours
Setter	:	
Vetted by	:	

INSTRUCTIONS TO CANDIDATES

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen with non-erasable ink.
You may use a pencil for any diagrams or graphs.
Do **not** use correction fluid or correction tape.

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

Section A:
If working is needed for any question it must be shown in the space below that question.

Section B:
Answer **all** questions.
At the end of the examination, fasten all your work securely together.

Error in	Marks Deducted
Presentation	
Accuracy	
Missing/Wrong Units	

Section	**Marks**	
A		**50**
B		**30**
Total		**80**

The marks for each question or part of a question are shown in the brackets [ ].

The total mark for this paper is **80**.

This paper consists of **10** printed pages including this cover page.

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1. (a) Express 216 as a product of its prime factors, leaving your answers in index notation.

(b) **Hence** evaluate $\sqrt[3]{216}$.

Answer (a) _____ [2]

(b) _____ [2]

2. Write down and simplify an algebraic expression for each of the following:

(a) Subtract $2x$ from the quotient of y divided by z.

(b) Multiply the product of $3a$ and $2ab$ by b^2.

Answer (a) _____ [1]

(b) _____ [1]

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3. Refer to the numbers below.

$$-0.8, \quad \frac{1}{4}, \quad 3, \quad -\frac{\pi}{2}, \quad 1$$

Write down

(a) the prime number(s).

(b) the rational number(s)

Answer (a) _____ [1]

(b) _____ [2]

4. Use a calculator to evaluate each of the following.

(a) $\sqrt{\dfrac{3\frac{3}{7}+(-2.3)}{(0.05)^3}}$, giving your answer correct to 2 decimal places.

(b) $\left[1\frac{5}{7}-1.6\div(-0.8)\right]-3.7$, giving your answer correct to 3 significant figures.

Answer (a) _____ [2]

(b) _____ [2]

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5. (a) Estimate $\frac{3.95\times4.1}{1.8}$ by rounding off each number to the nearest whole number.

(b) Use your answer from part (a) to estimate the value of $\frac{395\times41}{18}$.

Answer (a) _____ [2]

(b) _____ [2]

6. **Without using a calculator and showing all the steps clearly**, evaluate the following and leave your answer as a fraction in its lowest term.

$$\left(\frac{1}{2}\right)^2+\left[-3\frac{1}{2}\div\frac{1}{3}\times\frac{6}{5}\right]$$

Answer _____ [3]

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7. During the IT fair, a thumb drive cost \$15 and an external hard disk cost \$80. Lucky company sold $2m$ thumb drives and $(m + 30)$ external hard disks.
Write down and simplify an algebraic expression for the amount, in dollars, that Lucky company earned from the IT fair.

Answer _____ [2]

8. Find the value of y in each of the following.

(a) $y = \dfrac{a + b^2}{a}$, given $a = 4$, $b = -3$

(b) $y = 2mn$, given $m = -\dfrac{1}{2}$, $n = 6$

Answer (a) _____ [2]

(b) _____ [2]

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9. Simplify each of the following, showing your working clearly.

(a) $-p(3p+2-4qr)$

(b) $\frac{2}{x}-\frac{5}{2x+1}$

(c) $1+\frac{u-2}{2}+\frac{4u-5}{3}$

Answer (a) _____ [2]

(b) _____ [3]

(c) _____ [3]

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10. 168 boys and 180 girls are going to visit the old folks' home as part of their service learning programme. The boys and girls are to be equally divided into groups.

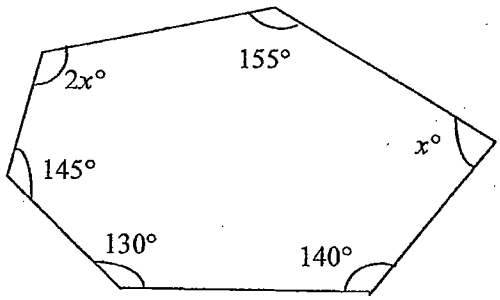
(a) What is the largest number of groups that can be formed?

(b) How many boys and girls are there in each group?

Answer (a) _____ [2]

(b) _____ boys _____ girls [2]

11. With reference to the diagram below, form an equation in x and solve it to find the value of x.



Answer _____ [3]

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12. An exterior angle of a regular n-sided polygon is 36°. Find the number of sides of the polygon.

Answer _____ [2]

13. (a) Given the line AB, construct ΔABC such that $BC = 8\ cm$ and $AC = 10\ cm$ [2]

On the same diagram,

(b) Construct the perpendicular bisector of the line BC which cuts AB at Y. Mark Y clearly on your diagram. [2]

(c) Construct the angle bisector of $\angle BAC$ which cuts BC at Z. Mark Z clearly on your diagram. [2]

(d) Measure and write down the value of $\angle CAY$.

Answer to (a), (b) and (c):

A *B*

Answer (d) _____ [1]

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1 (a) (i) Factorise $a^2 - ac$. [1]

(ii) Using your answer from part (ai), find the value of $123^2 - 123 \times 23$ without the use of calculator. [2]

(b) Factorise $2s(3r-1) - 5(1-3r)$. [2]

---

2. Solve the following equations

(a) $\frac{4}{x-3} = \frac{1}{2}$ [2]

(b) $x - \frac{2x-1}{3} = 5$ [3]

---

3. (a) Consider the following pattern.

Line 1: $1 - \frac{1}{2} = \frac{1}{1(2)} = \frac{1}{2}$

Line 2: $\frac{1}{2} - \frac{1}{3} = \frac{1}{2(3)} = \frac{1}{6}$

Line 3: $\frac{1}{3} - \frac{1}{4} = \frac{1}{3(4)} = \frac{1}{12}$

...

...

(i) Write down Line 4. [1]

(ii) Write down Line n, which is the nth line of the sequence. [2]

(b) (i) Find the 5^{th} term of a sequence given that the general term of the sequence is $T_n = 8 - 7n$. [2]

(ii) Find the value of n when $T_n = -55$. [2]

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4. Ms Ang drove 90 km from A to B at an average speed of x km/h. She then travelled 100 km from B to C at an average speed that is 8 km/h **faster**. Given that the time taken to travel both distances is the same,

(a) Write down an algebraic expression for the time taken to travel from A to B. [1]

(b) Write down an algebraic expression for the time taken to travel from B to C. [1]

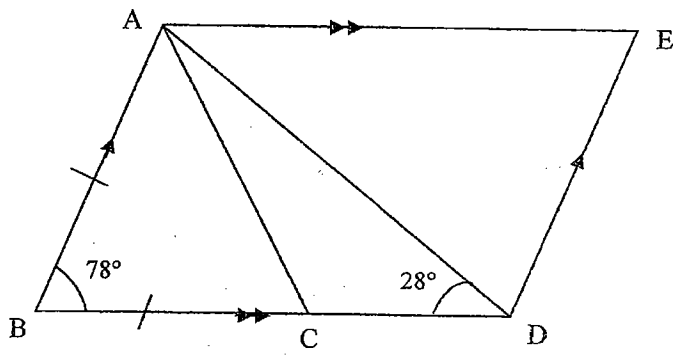
(c) Form an equation in x and solve it to find

(i) the speed from A to B. [2]

(ii) the speed from B to C. [1]

---

5. In the figure below, $ABDE$ is a parallelogram, $AB = BC$, $\angle ABC = 78°$ and $\angle ADC = 28°$.



Writing down the reasons clearly, find the value of

(a) $\angle AED$ [1]

(b) $\angle DAE$ [1]

(c) $\angle BAE$ [1]

(d) $\angle ACD$ [3]

(e) Reflex $\angle ADE$ [2]

End of Paper

Check your answers carefully.

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1. (a) Express 216 as a product of its prime factors, leaving your answers in index notation.
(b) **Hence** evaluate $\sqrt[3]{216}$.

(a) 216 [M1] for factor tree or ladder method
$= 2^3 \times 3^3$ [A1]

(b) $\sqrt[3]{216}$
$= \sqrt[3]{2^3 \times 3^3}$
$= 2 \times 3$ [M1] for correct cube root
$= 6$ [A1]

Answer (a) _____ [2]

(b) _____ [2]

2. Write down and simplify an algebraic expression for each of the following:
(a) Subtract $2x$ from the quotient of y divided by z.
(b) Multiply the product of $3a$ and $2ab$ by b^2.

(a) $\frac{y}{z} - 2x$ or $\frac{y - 2xz}{z}$ [B1]

(b) $3a(2ab)(b^2) = 3 \times a \times 2 \times a \times b \times b \times b$
$= 6a^2b^3$ [B1]

Answer (a) _____ [1]

(b) _____ [1]

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3. Refer to the numbers below.

$$-0.8, \quad \frac{1}{4}, \quad 3, \quad -\frac{\pi}{2}, \quad 1$$

Write down
(a) the prime number(s).
(b) the rational number(s).

(a) Prime number: 3 [B1]

(b) Rational numbers: $-0.8, \frac{1}{4}, 3, 1$ [B2] for all correct
[B1] for 3 correct
[B0] for 2 or less

Answer (a) _____ [1]

(b) _____ [2]

4. Use a calculator to evaluate each of the following.

(a) $\sqrt{\dfrac{3\frac{3}{7}+(-2.3)}{(0.05)^3}}$, giving your answer correct to 2 decimal places.

(b) $\left[1\frac{5}{7}-1.6\div(-0.8)\right]-3.7$, giving your answer correct to 3 significant figures.

(a)
$\sqrt{\dfrac{3\frac{3}{7}+(-2.3)}{(0.05)^3}} = 95.01879513$ [M1]

$= 95.02$ (2 dec. place) [A1] or [B2]

(b) $\left[1\frac{5}{7}-1.6\div(-0.8)\right]-3.7$
$= 0.0142857$ [M1]
$= 0.0143$ (3 sig. fig.) [A1] or [B2]

Answer (a) _____ [2]

(b) _____ [2]

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5. (a) Estimate $\frac{3.95\times 4.1}{1.8}$ by rounding off each number to the nearest whole number.

(b) Use your answer from part (a) to estimate the value of $\frac{395\times 41}{18}$.

(a) $\frac{3.95\times 4.1}{1.8} \approx \frac{4\times 4}{2}$ (nearest whole number) [M1]

$= 8$ [A1]

(b) $\frac{395\times 41}{18} = \frac{3.95\times 100\times 4.1\times 10}{1.8\times 10}$

$= \frac{3.95\times 4.1}{1.8}\times 100$ [M1]

$\approx 8\times 100$

$= 800$ [A1]

Answer (a) _____ [2]

(b) _____ [2]

6. **Without using a calculator and showing all the steps clearly**, evaluate the following and leave your answer as a fraction in its lowest term.

$$\left(\frac{1}{2}\right)^2 + \left[-3\frac{1}{2} \div \frac{1}{3} \times \frac{6}{5}\right]$$

$\left(\frac{1}{2}\right)^2 + \left[-3\frac{1}{2} \div \frac{1}{3} \times \frac{6}{5}\right]$

$= \frac{1}{4} + \left[-\frac{7}{2} \times \frac{3}{1} \times \frac{6}{5}\right]$ [M1 for correct working of changing of ÷ sign to × sign]

$= \frac{1}{4} + \left[-\frac{126}{10}\right]$ [M1 for showing correct workings of inner brackets]

$= \frac{5}{20} - \frac{252}{20}$

$= -\frac{247}{20}$ or $-12\frac{7}{20}$ [A1]

Answer _____ [3]

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7. During the IT fair, a thumb drive cost \$15 and an external hard disk cost \$80. Lucky company sold $2m$ thumb drives and $(m + 30)$ external hard disks.
Write down and simplify an algebraic expression for the amount, in dollars, that Lucky company earned from the IT fair.

Amount earned
$= 15(2m) + 80(m + 30)$ [M1]
$= 30m + 80m + 2400$
$= 110m + 2400$

Amount earned is $\$(110m + 2400)$ [A1]

Answer _____ [2]

8. Find the value of y in each of the following.

(a) $y = \frac{a + b^2}{a}$, given $a = 4$, $b = -3$

(b) $y = 2mn$, given $m = -\frac{1}{2}$, $n = 6$

(a) $y = \frac{a + b^2}{a}$

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

$y = \frac{4 + 9}{4}$ [M1] for correct substitution and evaluation of $(-3)^2$

$y = \frac{13}{4}$ or $y = 3\frac{1}{4}$ [A1]

(b) $y = 2mn$

$y = 2(-\frac{1}{2})(6)$ [M1]

$y = -1(6)$

$y = -6$ [A1]

Answer (a) _____ [2]

(b) _____ [2]

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9. Simplify each of the following, showing your working clearly.

(a) $-p(3p+2-4qr)$

(b) $\dfrac{2}{x}-\dfrac{5}{2x+1}$

(c) $1+\dfrac{u-2}{2}+\dfrac{4u-5}{3}$

(a) $-p(3p+2-4qr)$

$=-3p^2-2p+4pqr$ [M1] for correct sign

[M1] for p correctly multiply in

(b) $\dfrac{2}{x}-\dfrac{5}{2x+1}$

$=\dfrac{2(2x+1)}{x(2x+1)}-\dfrac{5x}{x(2x+1)}$ [M1] for common denominator

$=\dfrac{4x+2-5x}{x(2x+1)}$ [M1] correct expression after removing bracket

$=\dfrac{2-x}{x(2x+1)}$ [A1]

(c) $1+\dfrac{u-2}{2}+\dfrac{4u-5}{3}$

$=\dfrac{6}{6}+\dfrac{3(u-2)}{6}+\dfrac{2(4u-5)}{3}$ [M1] for common denominator

$=\dfrac{6+3(u-2)+2(4u-5)}{6}$

$=\dfrac{6+3u-6+8u-10}{6}$ [M1] for correct expression after removing bracket

$=\dfrac{11u-10}{6}$ [A1]

Answer (a) _____ [2]

(b) _____ [3]

(c) _____ [3]

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10. 168 boys and 180 girls are going to visit the old folks' home as part of their service learning programme. The boys and girls are to be equally divided into groups.

(a) What is the largest number of groups that can be formed?

(b) How many boys and girls are there in each group?

(a) $168 = 2^3 \times 3 \times 7$
$180 = 2^2 \times 3^2 \times 5$ } [M1] showing the prime factorisation in index notation

$HCF = 2^2 \times 3$
$= 12$ [A1]

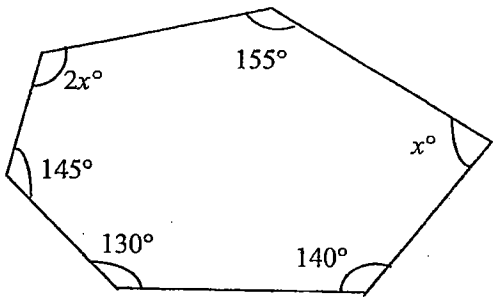
(b) no. of boys $= 168 \div 12$
$= 14$ [B1]

No. of girls $= 180 \div 12$
$= 15$ [B1]

Answer (a) _____ [2]

(b) _____ boys _____ girls [2]

11. With reference to the diagram below, form an equation in x and solve it to find the value of x.



sum of interior angles $= (6-2) \times 180°$ ($\angle$ sum of polygon) [M1]
$= 720°$

$2x° + 145° + 130° + 140° + x° + 155° = 720°$ [M1] form eqn

$3x° + 570° = 720°$

$3x° = 150°$

$x° = 50°$

$x = 50$ [A1]

Answer _____ [3]

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12. An exterior angle of a regular n-sided polygon is 36°. Find the number of sides of the polygon.

$n = 360° \div 36°$ (ext. angle sum of polygon) [M1] applying exterior angle formula
$n = 10$ [A1]

Answer _____ [2]

13. (a) Given the line AB, construct ΔABC such that $BC = 8$ *cm* and $AC = 10$ *cm* [2]

On the same diagram,

(b) Construct the perpendicular bisector of the line BC which cuts AB at Y. [2]
Mark Y clearly on your diagram.

(c) Construct the angle bisector of $\angle BAC$ which cuts BC at Z. [2]
Mark Z clearly on your diagram.

(d) Measure and write down the value of $\angle CAY$.

Answer to (a), (b) and (c):

A *B*

Answer (d) _____ [1]

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Section B (30 marks)

1 (a) (i) Factorise $a^2 - ac$. [1]

(ii) Using your answer from part (ai), find the value of $123^2 - 123 \times 23$ without the use of calculator. [2]

(b) Factorise $2s(3r-1) - 5(1-3r)$. [2]

(ai) $a^2 - ac = a(a-c)$ [B1]

(aii) $123^2 - 123 \times 23 = 123(123-23)$ [M1] form taking out common factor

$= 123(100)$

$= 12300$ [A1]

(b) $2s(3r-1) - 5(1-3r)$

$= 2s(3r-1) + 5(3r-1)$ [M1] changing to common factor

$= (3r-1)(2s+5)$ [A1]

---

2. Solve the following equations

(a) $\frac{4}{x-3} = \frac{1}{2}$ [2]

(b) $x - \frac{2x-1}{3} = 5$ [3]

(a) $\frac{4}{x-3} = \frac{1}{2}$

$2(x-3)\frac{4}{x-3} = 2(x-3)\frac{1}{2}$ [M1] multiply both side by LCM

$2(4) = x-3$

$8 = x-3$

$x = 11$ [A1]

(b) $x - \frac{2x-1}{3} = 5$

$3x - (3)\frac{2x-1}{3} = 15$ [M1] multiply both side by LCM

$3x - (2x-1) = 15$

$3x - 2x + 1 = 15$ [M1] Correct expression after removing brackets

$x = 14$ [A1]

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3. (a) Consider the following pattern.

Line 1: $1-\frac{1}{2}=\frac{1}{1(2)}=\frac{1}{2}$

Line 2: $\frac{1}{2}-\frac{1}{3}=\frac{1}{2(3)}=\frac{1}{6}$

Line 3: $\frac{1}{3}-\frac{1}{4}=\frac{1}{3(4)}=\frac{1}{12}$

...

...

(i) Write down Line 4. [1]

(ii) Write down Line n, which is the nth line of the sequence. [2]

(b) (i) Find the 5^{th} term of a sequence given that the general term of the sequence is $T_n=8-7n$. [2]

(ii) Find the value of n when $T_n=-55$. [2]

(ai) Line 4: $\frac{1}{4}-\frac{1}{5}=\frac{1}{4(5)}=\frac{1}{20}$ [B1]

(aii) Line n: $\frac{1}{n}-\frac{1}{(n+1)}=\frac{1}{n(n+1)}=\frac{1}{n^2+n}$

or $\frac{1}{n}-\frac{1}{(n+1)}=\frac{1}{n(n+1)}=\frac{1}{n(n+1)}$ [B1 for LHS, B1 for RHS]

(bi) $T_5=8-7(5)$ [M1] correct substitution

$=8-35$

$=-27$ [A1]

(bii) $T_n=-55$

$-55=8-7n$ [M1] forming eqn

$-55-8=-7n$

$-63=-7n$

$n=9$ [A1]

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4. Ms Ang drove 90 km from A to B at an average speed of x km/h. She then travelled 100 km from B to C at an average speed that is 8 km/h **faster**. Given that the time taken to travel both distances is the same,

(a) Write down an algebraic expression for the time taken to travel from A to B. [1]

(b) Write down an algebraic expression for the time taken to travel from B to C. [1]

(c) Form an equation in x and solve it to find

(i) the speed from A to B. [2]

(ii) the speed from B to C. [1]

(a) Time taken to travel from A to B $= \frac{90}{x}$ [B1]

(b) Time taken to travel from B to C $= \frac{100}{x+8}$ [B1]

(c) $\frac{90}{x} = \frac{100}{x+8}$

$(x)(x+8)\frac{90}{x} = (x)(x+8)\frac{100}{x+8}$ [M1] for multiplying both side by the LCM

$90(x+8) = 100x$

$90x + 720 = 100x$

$10x = 720$

$x = 72$

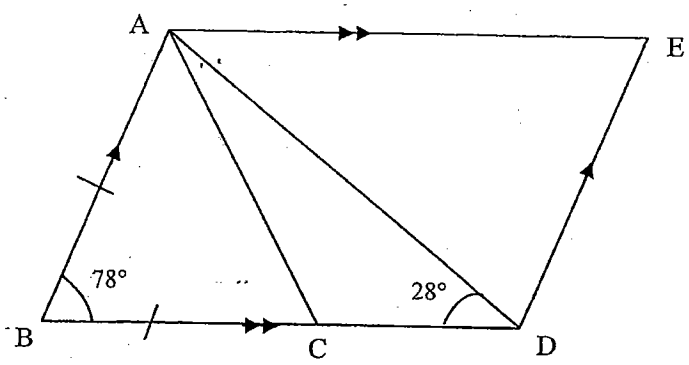
(i) Speed from A to B is 72 km/h [A1]

$x + 8 = 80$

(ii) Speed from B to C is 80 km/h. [A1]

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5. In the figure below, $ABDE$ is a parallelogram, $AB = BC$, $\angle ABC = 78°$ and $\angle ADC = 28°$.



Writing down the reasons clearly, find the value of

(a) $\angle AED$ [1]

(b) $\angle DAE$ [1]

(c) $\angle BAE$ [1]

(d) $\angle ACD$ [3]

(e) Reflex $\angle ADE$ [2]

(a) $\angle AED = 78°$ (opp. $\angle$s of a //gram) [B1]

(b) $\angle DAE = 28°$ (alt. $\angle s$, AE // BD) [B1]

(c) $\angle BAE = 180° - 78°$ (int $\angle s$, AE//BD)
$= 102°$ [B1]

(d) $\angle BAC = (180° - 78°) \div 2$ (base $\angle s$ of a isos. Δ) [M1]
$= 51°$

$\angle ACD = 78° + 51°$ (ext $\angle$ of Δ)
$= 129°$

Or $\angle ACD = 180° - 51°$ (adj. $\angle s$ on a st. line) [M1]
$= 129°$ [A1]

(d) $\angle ADE = 102° - 32°$
$= 70°$

Reflex $\angle ADE = 360° - 72°$ ($\angle s$ at a point) [M1]
$= 288°$ [A1]

End of Paper

Check your answers carefully.

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