YEAR 11

Casimir Catholic College

2012 PRELIMINARY ASSESSMENT TASK 1

Mathematics Extension 1

General Instructions

- Working Time – 50 minutes
- Write using blue or black pen
- Board-approved calculators may be used
- Start each question on a new page
- All necessary working should be shown in every question
- All diagrams are not to scale unless otherwise stated

Section One
Multiple Choice
Total marks (4)

Section Two
Total marks (44)
Answer questions 5-8

NAME:_____

TEACHER:................................

Section One Multiple Choice.

Question One.   1

$\sqrt[3]{\dfrac{(7\cdot96)^8}{(5\cdot78-2\cdot44)^2}}$ expressed in scientific notation correct to 3 significant figures is:

A.   113   B. $113\cdot050$

C. $1\cdot130\times10^2$ D. $1\cdot13\times10^2$

Question Two.   1

Express $8^{-\frac{2}{3}}$ in simplest form, with a positive integer index.

A. $\dfrac{1}{4}$ B.   4

C. $\dfrac{1}{\sqrt[3]{8}}$ D.   -2

Question Three.   1

Expand and simplify: $\left(1+\dfrac{1}{x}\right)^2$

A. $1+\dfrac{1}{x^2}$ B. $1+\dfrac{2}{x}+\dfrac{1}{x^2}$

C. $2+\dfrac{4}{x}+\dfrac{2}{x^2}$ D. $1+\dfrac{1}{x^2}+x^2$

Question Four.   1

The solution(s) to $|3x-1|=x-5$ is:

A.   -2 and 2   B.   -2 only

C.   -2 and $1\dfrac{1}{2}$ D.   There are no solutions

Section Two Extended Response Questions.

Question Five.   **(Start a new booklet)**   **11 marks**

(a)   Convert $1\cdot034$ to a:

      (i)   percentage.   1

      (ii)   fraction.   1

(b)   Find the value of $\dfrac{A^3 C^2}{B^5}$ where $A = \left(\dfrac{3}{4}\right)^3$, $B = \left(\dfrac{3}{8}\right)^2$ and $C = \dfrac{3}{2}$; expressing

      your answer in simplest index form.   2

(c)   Write $1\cdot0\overset{..}{3}4$ as a fraction in its lowest form.   2

(d)   Simplify $2\sqrt{54} + \sqrt{150}$.   2

(e)   (i)   Rationalise the denominator of $\dfrac{\sqrt{2}}{3\sqrt{2}-1}$.   1

      (ii)   Hence find values a and b if $\dfrac{\sqrt{2}}{3\sqrt{2}-1} = a + b\sqrt{2}$.   2

Question Six.   **(Start a new booklet)**   **11 marks**

(a)   Expand and simplify:

      (i) $5 + 3(2y-5) - (y-6)$.   1

      (ii) $(\sqrt{x}-x)(\sqrt{x}+x)$.   1

      (iii) $\left(12 - w^2\right)^2$.   1

(b)   Factorise fully:

      (i) $15x^2 y - 3xy + 21xy^2$.   1

      (ii) $3x^2 - 16x + 5$.   2

      (iii) $27m^3 + 8n^3$.   2

(c)   Simplify: $\dfrac{3}{y^2-4} - \dfrac{2}{y^2+5y-14}$.   3

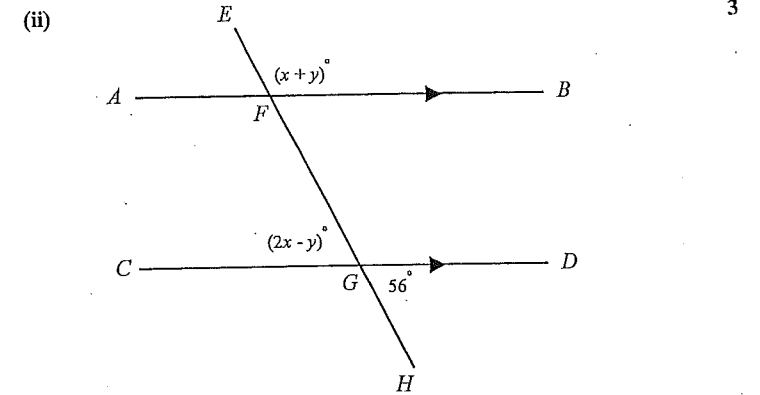**Question Seven.**   (Start a new booklet)   **11 marks**

(a)   Solve: $-2x = 4(3-2x)$.   1

(b)   Solve: $\dfrac{x}{5} > x+4$.   2

(c)   Solve: $|2x+5| = |3x+9|$.   3

(d)   Solve: $\dfrac{3}{y} < -2$.   2

(e)   Solve: $\dfrac{x+3}{x-1} \le 2$.   3

Question Eight.   (Start a new booklet)   **11 marks**

(a)   Find the values of the pronumerals, giving complete reasons:

(i)   2

(ii)   3
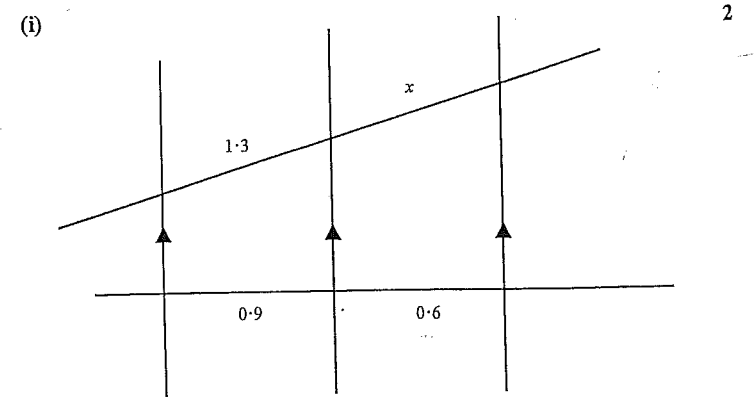
(b)   *ABCD* is a parallelogram with *CD* produced to *E*, as shown in the diagram.

Prove that $\triangle ABF \parallel\mid\mid \triangle CEB$.   **2**
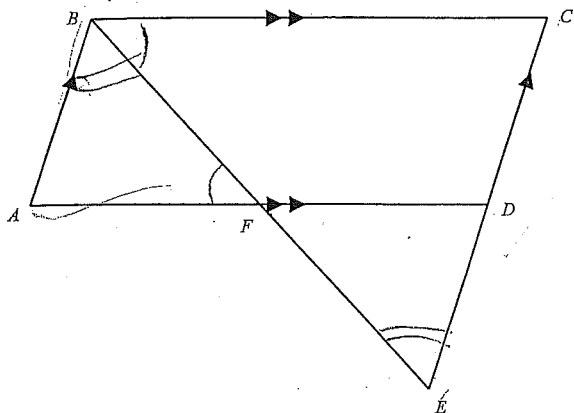
(c)   In the diagram below, *ABCD* is a square and *CB* is produced to *E* such that

$$BE = \frac{1}{2}BC.$$

If *CD* = *a*, show that the length of *AE* is given by $\dfrac{a\sqrt{5}}{2}$ units.   **2**

(d)   For a 15-sided regular polygon, find the size of each:

(i)   interior angle.   **1**

(ii)   exterior angle.   **1**

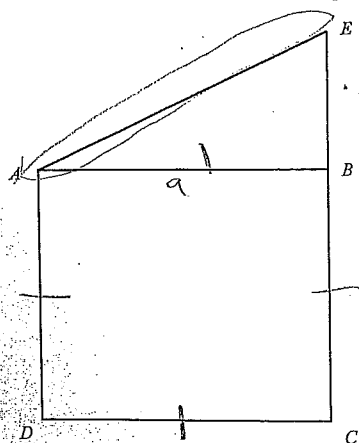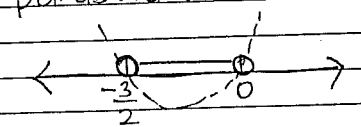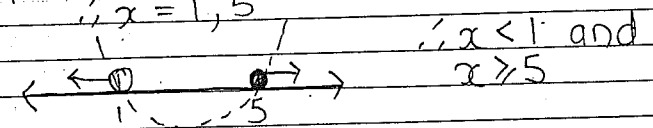| Qn	Solution	Marks
5.	(a) 1·034	
	(i) 103·4 %	1
	(ii) $\dfrac{517}{500} = 1\frac{17}{500}$	1
	(b) $\dfrac{A^3 C^2}{B^5} = \dfrac{\left(\left(\frac{3}{4}\right)^3\right)^2 \left(\frac{3}{2}\right)^2}{\left(\left(\frac{3}{8}\right)^2\right)^5}$	1
	in calc: $= 3072$	1
	in index: $= \left[\dfrac{3^9}{4^9} \times \dfrac{3^2}{2^2}\right] \div \left[\dfrac{3^{10}}{8^{10}}\right]$	
	$= \left[\dfrac{3^9}{2^{18}} \times \dfrac{3^2}{2^2}\right] \times \dfrac{2^{30}}{3^{10}}$	
	$= \dfrac{3^{11}}{2^{20}} \times \dfrac{2^{30}}{3^{10}}$	
	$= 3 \times 2^{10}$	2
	(c) $1·0\overline{34} = x$	
	$10x = 10·\overline{34}$	
	$1000x = 1034·\overline{34}$	
	$990x = 1024$	
	$x = \dfrac{512}{495}$	2
	(d) $2\sqrt{54} + \sqrt{150} = 6\sqrt{6} + 5\sqrt{6}$	1
	$= 11\sqrt{6}$	2
	(e) (i) $\dfrac{\sqrt{2}}{3\sqrt{2}-1} \times \dfrac{3\sqrt{2}+1}{3\sqrt{2}+1} = \dfrac{6+\sqrt{2}}{17}$	1
	(ii) $\dfrac{6+\sqrt{2}}{17} = a + b\sqrt{2}$	
	$\therefore a = \frac{6}{17}$ and $b = \frac{1}{17}$	2

Qn	Solution	Marks
6.	(a) (i) $5 + 3(2y-5) - (y-6) = 5 + 6y - 15 - y + 6$	
	$= -4 + 5y$	
	$= 5y - 4$	1
	(ii) $(\sqrt{x} - x)(\sqrt{x} + x) = x - x^2$	1
	(iii) $(12 - w^2)^2 = 144 - 24w^2 + w^4$	1
	(b) (i) $15x^2 y - 3xy + 21xy^2 = 3xy(5x - 1 + 7y)$	1
	(ii) $3x^2 - 16x + 5 = \dfrac{(3x - 15)(3x - 1)}{3}$	1
	$= (x - 5)(3x - 1)$	2
	(iii) $27m^3 + 8n^3 = (3m + 2n)(9m^2 - 6mn + 4n^2)$	2
	(c) $\dfrac{3}{y^2 - 4} - \dfrac{2}{y^2 + 5y - 14}$	
	$= \dfrac{3}{(y-2)(y+2)} - \dfrac{2}{(y+7)(y-2)}$	1
	$= \dfrac{3(y+7) - 2(y+2)}{(y-2)(y+2)(y+7)}$	2
	$= \dfrac{3y + 21 - 2y - 4}{(y-2)(y+2)(y+7)}$	
	$= \dfrac{y + 17}{(y-2)(y+2)(y+7)}$	3

Qn	Solution	Marks
7.	**(a)** $-2x = 4(3-2x)$	
	$-2x = 12 - 8x$	
	$6x = 12$	
	$\therefore x = 2$	1
	(b) $\dfrac{x}{5} > x + 4$	
	$x > 5x + 20$	
	$-20 > 4x$	
	$-5 > x$	
	$\therefore x < -5$	2
	(c) $|2x+5| = |3x+9|$	
	• case 1 (both positive): test $x = -4$:	
	$2x+5 = 3x+9$ $|2(-4)+5| = |3(-4)+9|$	
	$-4 = x$ $|-3| = |-3|$	
	$\therefore x = -4$ $3 = 3$ ✓(T)	1
	• case 2 (1st positive, 2nd negative): test $x = -2\frac{4}{5}$:	
	$2x+5 = -3x-9$ $\left|2(-2\frac{4}{5})+5\right| = \left|-\frac{3}{5}\right|$	
	$5x = -14$ $\left|3(-2\frac{4}{5})+9\right| = \left|\frac{3}{5}\right|$	
	$x = -2\frac{4}{5}$ $\frac{3}{5} = \frac{3}{5}$ ✓(T)	
	• case 3 (1st negative, 2nd positive):	
	$-2x-5 = 3x+9$	
	$-14 = 5x$	2
	$x = -2\frac{4}{5}$	
	• case 4 (both negative):	
	$-2x-5 = -3x-9$	
	$x = -4$	
	$\therefore$ solutions are $x = -4, -2\frac{4}{5}$	3
7	**(d)** $\dfrac{3}{y} < -2$ $y \neq 0$	
	$\dfrac{3}{y} y^2 < -2y^2$	1
	$3y < -2y^2$	
	$2y^2 + 3y < 0$ "parabola below axis"	
	$y(2y+3) = 0$	
	$\therefore y = 0, -\dfrac{3}{2}$	
	$\therefore -\dfrac{3}{2} < y < 0$	2
	(e) $\dfrac{x+3}{x-1} \leq 2$ $x \neq 1$	
	$(x+3)(x-1) \leq 2(x-1)^2$	
	$0 \leq 2(x-1)^2 - (x+3)(x-1)$	1
	$0 \leq (x-1)(2(x-1) - (x+3))$	
	$0 \leq (x-1)(x-5)$	2
	"parabola above axis"	
	$\therefore x = 1, 5$ $\therefore x < 1$ and	3
	$x \geq 5$	

Qn	Solution	Marks
8	(a)(i) $\dfrac{0.9}{0.6} = \dfrac{1.3}{x}$ (ratio of intercepts)	1
	$0.9x = 0.78$	
	$x = 0.87$ (2 dp)	2
	(ii) $\angle BFG = 56°$ (corresponding angles in parallel lines are equal)	
	$(x+y) + 56 = 180°$ (angles in a straight line are supplementary)	1
	$\therefore x + y = 124°$ ①	
	$(2x - y) = 56°$ (vertically opposite angles are equal)	
	$\therefore 2x - y = 56°$ ②	
	make y the subject of ① : $y = 124 - x$	2
	sub $y = 124 - x$ into ② : $2x - (124 - x) = 56$	
	$\qquad 2x - 124 + x = 56$	
	$\qquad\qquad 3x = 180$	
	$\qquad\qquad x = 60°$	
	sub $x = 60°$ into ① : $60 + y = 124$	
	$\qquad\qquad\qquad y = 64°$	
	thus $x = 60$ and $y = 64$	3
	(b) In $\triangle ABF$ and $\triangle CEB$:	
	$\angle ABF = \angle BEC$ (alternate angles in parallel lines are equal)	1
	$\angle BAF = \angle BCE$ (opposite angles in a parallelogram are equal)	
	$\therefore \triangle ABF \;\vert\vert\vert\; \triangle CEB$ (equiangular)	2
	(c) $CD = a$ (given) thus $CB = a$ (ABCD is a square)	
	In $\triangle ABE$; $AB = a$ (ABCD is a square)	
	$BE = \tfrac12 a$ $(BE = \tfrac12 BC$ and $BC = a)$	1
	$\angle EBA = 90°$ (CB produced to E and $\angle CBA = 90°$ as ABCD is a square)	
	thus $AE^2 = AB^2 + BE^2$ ($\triangle ABE$ is right-angled)	
	$\qquad = a^2 + (\tfrac12 a)^2 \qquad = \dfrac{5a^2}{4}$	2
	$\qquad = a^2 + \dfrac{a^2}{4}$	
	$\qquad = \dfrac{4a^2 + a^2}{4}$ $AE = \sqrt{\dfrac{5a^2}{4}} = \dfrac{a\sqrt5}{2}$ as required	

Qn	Solution	Marks
8	(d)(i) $S_n = 180(n-2)$	
	$S_{15} = 180(15-2)$	
	$= 2340°$	
	Each interior $= 2340° \div 15$	1
	$= 156°$	
	(ii) Exterior angle sum $= 360°$	
	Each exterior $= 360° \div 15$	
	$= 24°$	1

✱ <u>Answers</u>

YEAR 11 EXTENSION 1 MATHEMATICS – ASSESSMENT TASK ONE 2012

SECTION ONE MULTIPLE CHOICE ANSWER SHEET

1.   ○ A   ○ B   ○ C   ● D
2.   ● A   ○ B   ○ C   ○ D
3.   ○ A   ● B   ○ C   ○ D
4.   ○ A   ○ B   ○ C   ● D