

Student Name: _____



St Catherine's School
Waverley

St. Catherine's School
Year 11 Mathematics
Preliminary Task #1
08- March -2011

Time allowed: 55 minutes

Total marks: ~~58~~ 60 marks

Weighting: 15%

INSTRUCTIONS

- There are 2 sections of different values.
- Marks for each part of a question are indicated.
- Each section is to be attempted in a separate booklet.
- All necessary working should be shown.
- Start each question on a new page.
- Approved scientific calculators and drawing templates may be used.
- Marks may be deducted for careless or badly arranged work.

SECTION A ALGEBRA (38 Marks)

MARKS

Question 1: Expand and simplify the following:

(i) $5a(1-a) - a(2+a)$ 1

(ii) $(x^5 - y^5)(x^5 + y^5)$ 1

Question 2: Factorise the following fully:

(i) $2x^3 + 128$ 2

(ii) $ap^2 - aq^2$ 2

(iii) $x^3 - 7x^2 - 8x + 56$ 2

(iv) $2x^2 - x - 3$ 2

Question 3: Simplify

(i) $\frac{3a-3b}{a-b}$ 1

(ii) $\frac{2x+2}{x+3} \div \frac{x^2-16}{x^2-x-12}$ 2

(iii) $\frac{3}{x^2+x-2} - \frac{5}{x^2-2x-8}$ 2

Question 5:

MARKS

(i) If $S = \frac{a}{1-r}$ evaluate r when $S=20$ and $a=4.8$ 2

(ii) If $s = ut + \frac{1}{2}at^2$ find s if $u=4$, $t=5$ and $a=6.2$ 2

Question 6:

(i) If $2x^2 + 6x = 1$ find x leaving your answers as surds in simplest form 2

(ii) Solve simultaneously $7a - 5b = 16$ and $2a + 7b = 13$ 2

(iii) Solve simultaneously $y = 6x^2$ and $y = 4 - 5x$ 2

Question 4: Solve the following equations/inequations

(i) $6^x = \frac{1}{36}$ 1

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

(iii) $3 - 4(1+2x) > 9$ 2

(iv) $\sqrt{x^2 + 9} = 5$ 2

(v) $|2x+1| = 11$ 2

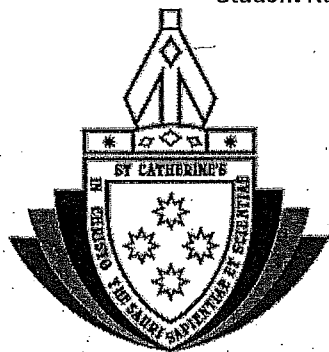
(vi) $|x-2| \leq 5$ 2

(viii) $|x-2| = 2x-5$ 2

SECTION B (NUMBER) (20 Marks)
START A NEW BOOKLET

	MARKS
Question 1: (i) If the earth travels around the sun at 30Km/sec find the distance it will travel in a day. (Write your answer in scientific notation correct to two significant figures)	2
(ii) Evaluate $\sqrt[3]{\frac{283}{\pi}}$ to three decimal places	1
(iii) Express $0.\overline{23}$ as a fraction in simplest form showing full working	2
(iv) If \$x is increased by 24% and the answer is reduced by 20% find the final amount as a decimal fraction of x	2
Question 2: (i) Simplify $(3\sqrt{5})^3$ leaving the answer as a surd	2
(ii) If $b\sqrt{3} = \frac{2}{\sqrt{3}} - \frac{\sqrt{3}}{2}$ find the value of b	2
(iii) Show that $7 + 4\sqrt{3} + \frac{1}{7+4\sqrt{3}}$ is rational	2
Question 3: (i) Evaluate $\log_6 9 + \log_6 4$	1
(ii) Calculate $\log_{10} 17$ to 3 decimal places	1
(iii) Evaluate $\log_3 \frac{1}{18} - \log_3 \frac{1}{2}$	2
(iv) If $\log_c 5 = x$ and $\log_c 10 = y$ find in terms of x and y	3
(a) $\log_c 50$ (b) $\log_c \frac{1}{2}$ (c) $\log_c 500$	

END OF TASK ©



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SOLUTIONS

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SECTION A

Qn	Solutions	Marks	Comments+Criteria
1	$i) 5a(1-a) - a(2+a)$ $= 5a - 5a^2 - 2a - a^2 = 3a - 6a^2$	1	
	$ii) (x^5 - y^5)(x^5 + y^5) = x^{10} - y^{10}$	1	
2	$i) 2x^3 + 128 = 2(x^3 + 64)$ $= 2(x+4)(x^2 - 4x + 16)$	2	
	$ii) ap^2 - aq^2 = a(p^2 - q^2)$ $= a(p+q)(p-q)$	2	
	$iii) x^3 - 7x^2 - 8x + 56$ $= x^2(x-7) - 8(x-7)$ $= (x-7)(x^2 - 8)$	2	
	$iv) 2x^2 - x - 3$ $= (2x-3)(x+1)$	1	
3	$i) \frac{3a-3b}{a-b} = \frac{3(a-b)}{(a-b)} = 3$	1	
	$ii) \frac{2x+2}{x+3} \div \frac{x^2-16}{x^2-x-12}$ $= \frac{2(x+1)}{x+3} \times \frac{(x-4)(x+3)}{(x-4)(x+4)}$ $= \frac{2(x+1)}{x+4}$	3	

Qn	Solutions	Marks	Comments+Criteria
3	$\text{iii) } \frac{3}{x^2+x-2} - \frac{5}{x^2-2x-8}$ $= \frac{3}{(x+2)(x-1)} - \frac{5}{(x-4)(x+2)}$ $= \frac{3(x-4) - 5(x-1)}{(x+2)(x-1)(x-4)}$ $= \frac{-2x}{(x+2)(x-1)(x-4)}$	3	
4	<p>i) $6^x = \frac{1}{36} = 6^{-2}$ $\therefore x = -2$</p> <p>ii) $\frac{2-x}{2+x} = \frac{3}{4}$ $4(2-x) = 3(2+x)$ $8-4x = 6+3x$ $-7x = -2$ $x = \frac{2}{7}$</p> <p>iii) $3 - 4(1+2x) > 9$ $3-4-8x > 9$ $-8x > 9+1$ $-8x > 10$ $x < -1\frac{1}{4}$</p> <p>iv) $\sqrt{x^2+9} = 5$ squaring $x^2+9 = 25$ $x^2 = 16$ $x = \pm 4$</p>	1 2 2	

Qn	Solutions	Marks	Comments+Criteria
4	<p>v) $2x+1 = 11$ $\therefore 2x+1 = 11$ or $2x+1 = -11$ $2x = 10$ $2x = -12$ $x = 5$ or $x = -6$</p> <p>vi) $x-2 \leq 5$ $-5 \leq x-2 \leq 5$ $-3 \leq x \leq 7$ $x-2 = 2x-5$</p> <p>vii) Consider $x-2 = 2x-5$ $-x = -3$ $x = 3$ check solution $3-2 = 2 \times 3 - 5$ ✓</p> <p>now consider $x-2 = -(2x-5)$ $x-2 = -2x+5$ $3x = 7$ $x = 2\frac{1}{3}$ check solution $2\frac{1}{3}-2 = 2 \times 2\frac{1}{3} - 5$ False $\therefore x = 3$ is only solution</p>	2 2 2	

Qn	Solutions	Marks	Comments+Criteria
5	<p>i) $S = \frac{a}{1-r}$</p> <p>$20 = \frac{4 \cdot 8}{1-r}$</p> <p>$20(1-r) = 4 \cdot 8$</p> <p>$20 - 20r = 4 \cdot 8$</p> <p>$-20r = 4 \cdot 8 - 20$</p> <p>$r = \frac{-15 \cdot 2}{-20} = 0.76$</p>	2	
	<p>ii) $A = ut + \frac{1}{2}at^2$</p> <p>$= 4 \times -5 + \frac{1}{2} \times 6 \cdot 2 \times (-5)^2$</p> <p>$= -20 + 77.5$</p> <p>$= 57.5$</p>	2	
6	<p>i) $2x^2 + 6x - 1 = 0$</p> <p>$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-6 \pm \sqrt{6^2 - 4 \times 2 \times -1}}{4}$</p> <p>$= \frac{-6 \pm \sqrt{44}}{4} = \frac{-6 \pm 2\sqrt{11}}{4} = \frac{-3 \pm \sqrt{11}}{2}$</p>	2	
	<p>ii) $7a - 5b = 16$ — (1)</p> <p>$2a + 7b = 13$ — (2)</p> <p>(1) $\times 7$ (2) $\times 5 \Rightarrow$</p> <p>$49a - 35b = 112$ — (3)</p> <p>$10a + 35b = 65$ — (4)</p> <p>Adding (3) and (4)</p> <p>$59a = 177$</p> <p>$a = 3$</p> <p>\therefore in (2) $2 \times 3 + 7b = 13 \Rightarrow b = 1$</p>	2	

Qn	Solutions	Marks	Comments+Criteria
6	<p>iii) $y = 6x^2$ — (1) $y = 4 - 5x$ — (2)</p> <p>substituting (2) into (1)</p> <p>$4 - 5x = 6x^2$</p> <p>$\therefore 6x^2 + 5x - 4 = 0$</p> <p>$(3x + 4)(2x - 1) = 0$</p> <p>$x = -\frac{4}{3}$ or $\frac{1}{2}$</p> <p>$\therefore y = 4 - 5x = 4 - 5 \times -\frac{4}{3} = 10\frac{2}{3}$</p> <p>or $y = 4 - 5x = 4 - 5 \times \frac{1}{2} = 1\frac{1}{2}$</p> <p>$\therefore (-\frac{4}{3}, 10\frac{2}{3})$ $(\frac{1}{2}, 1\frac{1}{2})$</p>		

SECTION B

Qn	Solutions	Marks	Comments+Criteria
1	<p>i) distance = $30 \times 60 \times 60 \times 24$ $= 2.6 \times 10^6$ km</p> <p>ii) $\sqrt[3]{\frac{283}{\pi}} = 4.483$ (3 d.p.)</p> <p>iii) $x = 0.23$ $100x = 23.23$ $x = .23$ subtracting $99x = 23$ $\Rightarrow x = \frac{23}{99}$</p> <p>iv) $\\$x \times 1.24 \times 0.8 = \\$0.992x$</p>	2 1 2 2	
2	<p>i) $(3\sqrt{5})^3 = 3^3 \times (\sqrt{5})^3 = 27 \times 5\sqrt{5}$ $= 135\sqrt{5}$</p> <p>ii) $\frac{2}{\sqrt{3}} - \frac{\sqrt{3}}{2} = \frac{2\sqrt{3}}{3} - \frac{\sqrt{3}}{2}$ $= \frac{4\sqrt{3} - 3\sqrt{3}}{6}$ $= \frac{\sqrt{3}}{6} = b\sqrt{3}$ $\therefore b = \frac{1}{6}$</p> <p>iii) $7 + 4\sqrt{3} + \frac{1}{7+4\sqrt{3}} \times \frac{7-4\sqrt{3}}{7-4\sqrt{3}}$ $= 7 + 4\sqrt{3} + \frac{7-4\sqrt{3}}{1} = 14$ Rational</p>	2 2 2	

Qn	Solutions	Marks	Comments+Criteria
3	<p>i) $\log_6 9 + \log_6 4 = \log_6 36 = 2$</p> <p>ii) $\log_{10} 17 = 1.230$ (3 d.p.)</p> <p>iii) $\log_3 \frac{1}{18} - \log_3 \frac{1}{2}$ $= \log_3 \left(\frac{1}{18} \times \frac{2}{1} \right) = \log_3 \frac{1}{9} = -2$</p> <p>iv) a) $\log_c 5 = x$ $\log_c 10 = y$ $\therefore \log_c 50 = \log_c 5 + \log_c 10$ $= x + y$</p> <p>b) $\log_c \frac{1}{2} = \log_c 5 - \log_c 10$ $= x - y$</p> <p>c) $\log_c 500 = \log_c 5 + \log_c 100$ $= \log_c 5 + 2\log_c 10$ $= x + 2y$</p>	1 1 2 1 1	