J.M.J.

MARCELLIN COLLEGE RANDWICK

YEAR 11

MATHEMATICS

ASSESSMENT TASK # 2
2013

Weighting: 40% of Preliminary Assessment Mark.

STUDENT NAME: _ ___________ **MARK:** **/ 65**

Time Allowed: **1 hour and 30 minutes**

Directions:

- Answer all questions on separate lined paper.
- Begin each question on a new page.
- Show all necessary working. Where more than one mark is allocated to a question, full marks may not be awarded for answers only.
- Marks may not be awarded for careless or badly arranged work.

Outcomes examined:
P1 – Demonstrates confidence in using mathematics to obtain realistic solutions to problems
P2 – Provides reasoning to support conclusions which are appropriate to the context
P3 – Performs routine arithmetic and algebraic manipulation involving surds and simple rational expressions.
P4 – Chooses and applies appropriate arithmetic, algebraic, graphical, trigonometric and geometric techniques
P5 – Understands the concept of a function and the relationship between a function and its graph

Section A – *Multiple Choice*

1 What is the value of $\frac{169.8-75}{14.2\times 2.8}$ correct to two significant figures?

(A) 2.3
(B) 2.4
(C) 2.38
(D) 2.39

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2 If $a=2\sqrt{b}-5$, what is the value of b when a is 1?

(A) 9
(B) -4
(C) 4
(D) -9

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3 Which statement is *not* true?

(A) $x^8 \div x^2 = x^4$
(B) $x^8 \times x^2 = x^{10}$
(C) $(x^8)^2 = (x^2)^8$
(D) $x^0 = 1$

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4 Simplify $\frac{4a^2-4ab}{16a^2-16b^2}$.

(A) $\frac{a}{4(a-b)}$

(B) $\frac{a-b}{4(a+b)}$

(C) $\frac{a-b}{4(a-b)}$

(D) $\frac{a}{4(a+b)}$

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5 What is the solution to the equation $x^4 - 9x^2 = 0$?

(A) $x = 0$ and $x = 9$
(B) $x = 0$ and $x = -9$
(C) $x = 0$ and $x = \pm 3$
(D) $x = -3$ and $x = 3$

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6 What is the solution to the inequality $|2x + 1| \leq 3$?

(A) $x \geq 1$ or $x \geq -2$
(B) $x \geq 1$or $x \geq 2$
(C) $x \leq 1$ or $x \geq -2$
(D) $x \leq 1$ or $x \geq 2$

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7 What is the value of $f(2a+1)$ if $f(x) = 3x - 2$?

(A) $6a - 2$
(B) $6a - 1$
(C) $6a + 1$
(D) $6a + 2$

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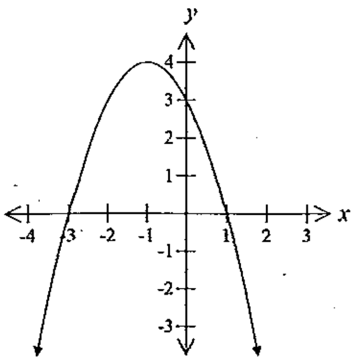
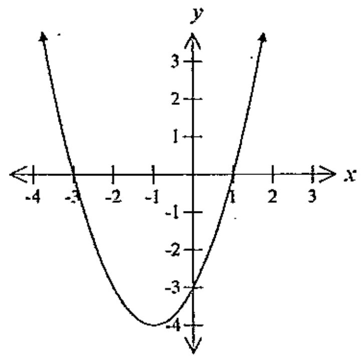
8 Which graph best represents $y = x^2 + 2x - 3$?

(A)



(B)



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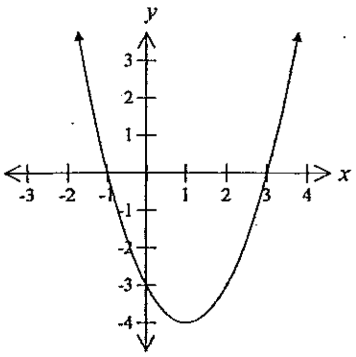
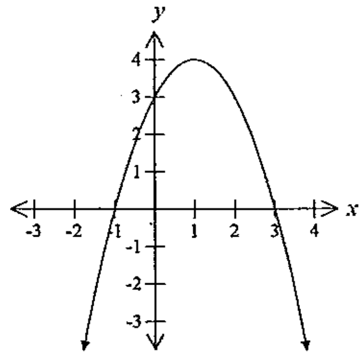


(D)



9 Which of the following is true for the function $f(x)=\frac{1}{x}$?

(A) Even function
(B) Odd function
(C) Neither odd or even
(D) Zero function

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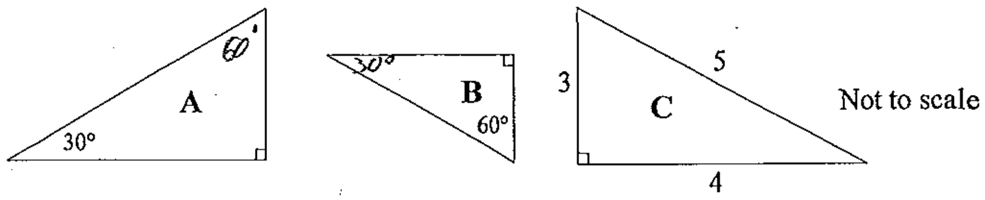


Which of the following statements is correct?

(A) Triangle A is similar to Triangle B
(B) Triangle A is similar to Triangle C
(C) Triangle C is similar to Triangle B
(D) Triangle A, B and C are all similar

End of Multiple Choice

Section B – *Short answers*

Question 11 *(15 marks)* 12 *START A NEW PAGE* **Marks**

(a) Factorise $x^3 - 27$. **1**

(b) Write $\dfrac{5}{2-\sqrt{3}}$ with a rational denominator. **2**

(c) Solve $3 - 5x \le 2$ and graph the solution on a number line. **3**

(d) Solve $(y-2)^2 = 9$ **2**

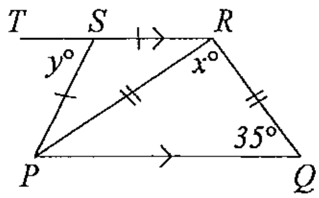
(e) Solve $8 - \dfrac{2x+1}{3} = \dfrac{8-x}{5}$. **2**

(f) Evaluate $\lim\limits_{h \to 3} \dfrac{3-h}{9-h^2}$. **2**

(g) Solve $|x+3| = 1 - 3x$. **3**

Question 12 *(16 marks)* *START A NEW PAGE* **Marks**

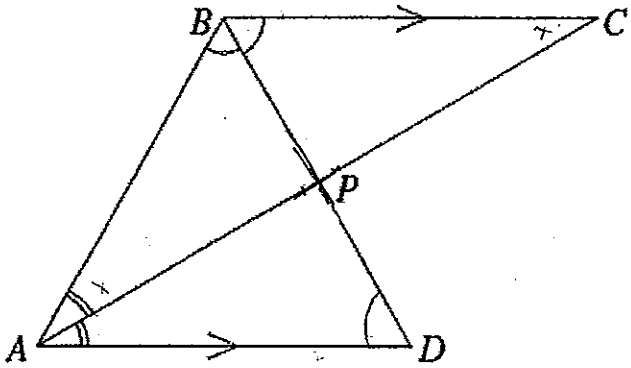
(a)



The diagram (not to scale) shows a quadrilateral $PQRS$, in which PQ is parallel to SR, $PS = SR$, and $PR = RQ$. Also, T is a point on RS produced.

Find the values of x and y, giving reasons. **3**

(b)

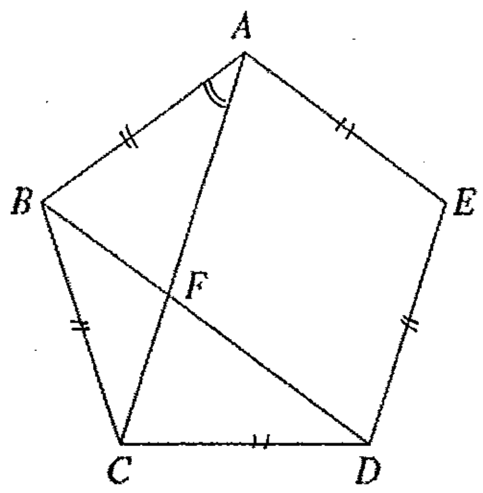


In the diagram, AD is parallel to BC, AC bisects $\angle BAD$ and BD bisects $\angle ABC$. The lines AC and BD intersect at P.

(i) Prove that $\angle BAC = \angle BCA$. **1**

(ii) Prove that $\Delta ABP \equiv \Delta CBP$. **2**

(c)



In the diagram, $ABCDE$ is a regular pentagon. The diagonals AC and BD intersect at F.

(i) Show that the size of $\angle ABC$ is $108°$. **1**

(ii) Find the size of $\angle BAC$. Give reasons for your answer. **2**

(iii) By considering the sizes of angles, show that ΔABF is isosceles. **2**

(d) Solve the following simultaneously, **3**

$$2x - y - 3 = 0$$
$$y = x^2 - 4x + 5$$

(e) Simplify $\dfrac{2x}{x^2+2x-3} - \dfrac{1}{x-1}$. **2**

Question 13 *(15 marks)* *START A NEW PAGE* **Marks**

(a) Given $f(x)=3x^2-5x+7$ find $f(-2)$. **1**

(b) Consider the function $f(x)=x^2-3x$.

(i) Write an expression for $f(x+h)$. Expand and simplify your answer. **2**

(ii) Hence find an expression for $\dfrac{f(x+h)-f(x)}{h}$. **2**

(c) Show that $g(x)=x^2-4x^4$ is an even function. **2**

(d) Sketch the following equations showing the x & y intercepts and stating the domain & range of each.

(i) $h(x)=x^2+3$. **2**

(ii) $y=-\sqrt{9-x^2}$. **2**

(iii) $f(x)=|3x-2|$. **2**

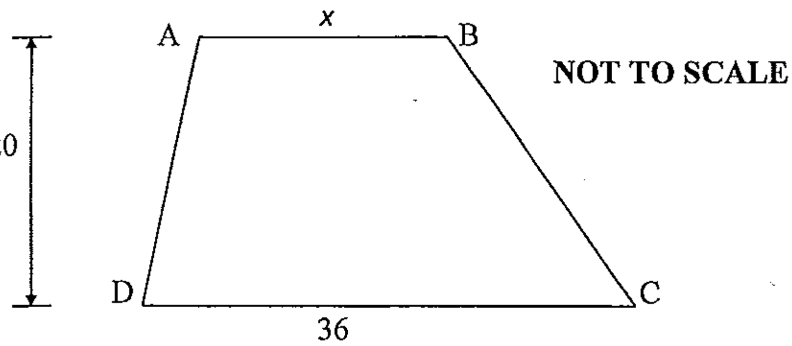
(iv) $g(x)=\dfrac{1}{x+2}+1$. **2**

Question 14 *(9 marks)* *START A NEW PAGE* **Marks**

(a) Shade the region of the number plane where the following inequalities hold simultaneously. **3**

$$y \geq |x| \text{ and } y < 4 - x^2.$$

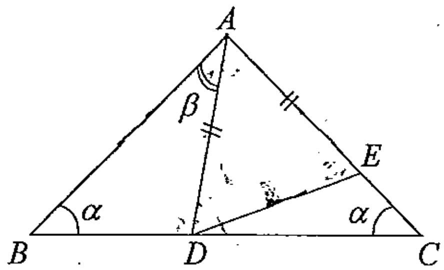
(b)



(i) Write down the formula for the area of a trapezium. **1**

(ii) Given the area of ABCD is 540 units^2, and using the formula above, or otherwise, find the value of x. **2**

(c)



In the isosceles triangle ABC, $\angle ABC = \angle ACB = \alpha$. The points D and E lie on BC and AC, so that $AD = AE$, as shown in the diagram. Let $\angle BAD = \beta$.

(i) Explain why $\angle ADC = \alpha + \beta$. **1**

(ii) Find $\angle DAC$ in terms of α and β. **2**

Marcellin College
Randwick

Year 11 Mathematics

Assessment task 2

2013.

MULTIPLE CHOICE

1. B
2. A
3. A
4. D
5. C
6. C
7. C
8. B.
9. B.
10. A

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Year 11 Mathematics
Assessment task 2. 2013

a) $x^3 - 27$

$= (x-3)(x^2+3x+9)$

b) $\frac{5}{2-\sqrt{3}} \times \frac{2+\sqrt{3}}{2+\sqrt{3}} = \frac{10+5\sqrt{3}}{4-3} = \frac{10-5\sqrt{3}}{1}$

$= 10 - 5\sqrt{3}$

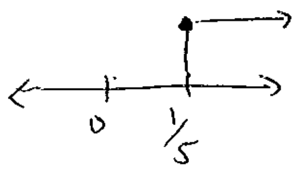
c) $3 - 5x \leq 2$

$-5x \leq 2-3$

$-5x \leq -1$

$5x \geq 1$

$x \geq \frac{1}{5}$



d) $(y-2)^2 = 9$

Because 3^2 and $(-3)^2 = 9$

$y-2$ must be equal to 3 or -3

Case 1 $y-2=3 \rightarrow y=5$

Case 2 $y-2=-3 \rightarrow y=-1$

$y = 5$ or -1

e) $8 - \frac{2x+1}{3} = \frac{8-x}{5}$

$\frac{24}{3} - \frac{2x+1}{3} = \frac{8-x}{5}$

$\frac{24-2x-1}{3} = \frac{8-x}{5}$

$\frac{23-2x}{3} \times \frac{8-x}{5}$

CROSS MULTIPLY

$5(23-2x) = 3(8-x)$

$115 - 10x = 24 - 3x$

$115 - 24 = 7x$

$7x = 91$

$x = 13$

f) $\lim_{h \to 3} \frac{3-h}{9-h^2}$

$= \lim_{h \to 3} \frac{3-h}{(3-h)(3+h)}$

$= \lim_{h \to 3} \frac{1}{(3+h)}$

$= \frac{1}{6}$ as h approaches 3.

g) $|x+3| = 1-3x$

Square both sides

$(x+3)^2 = (1-3x)^2$

$x^2 + 9 + 6x = 1 + 9x^2 - 6x$

$8x^2 - 12x - 8 = 0$

$4(2x^2 - 3x - 2) = 0$

$2x^2 - 3x - 2 = 0$

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

$x = 2$ or $-\frac{1}{2}$

Question 12

Because ΔRQP is isoceles

$\therefore \angle RPQ = 35°$

$\therefore \angle QRP = 180° - 35° - 35°$ (angle sum of triangle)

$\angle QRP = x = 110°$

$\angle QRT = 180° - 35°$ (Interior angles) $= 145°$

but $\angle QRT = x + \angle PRT$

$\therefore \angle PRT = \angle QRT - x$

$= 145° - 110° = 35°$

Since ΔSRP is isoceles

$\therefore \angle SPR$ is also 350

$\therefore \angle PSR = 180° - 35° - 35°$ (angle sum of triangle)

$\angle PSR = 110°$

$y = 180° - \angle PSR$ (angle sum of straight line)

$\therefore y = 180° - 110° = 70°$

b) $\angle BAC = \angle CAD$ (given)

$\angle CAD = \angle BCA$ (alternate angles)

$\therefore \angle BAC = \angle BCA$

ii) in ΔABP and ΔCBP

$\angle CBP = \angle ABP$ (given)

$\angle BAC = \angle BCA$ (part i)

$\therefore \angle BPC = \angle BPA$ (angle sum of triangle)

$\therefore \Delta ABP \equiv \Delta CBP$ (equiangular)

c) Sum of angles of an interior polygon $= (n-2) \times 180$

i) $\therefore$ Sum of interior angles in a pentagon $= (5-2) \times 180 = 540°$

$\therefore$ each individual Interior angle $= \frac{540}{5} = 108°$

ii) Consider ΔABC

Because $BA = BC$, ΔABC is isoceles with $\angle BAC =$ ~~$\angle ABC$~~ $\angle BCA$

let $\angle BAC$ be $\angle x$

$\therefore$ In ΔABC

$180 = 108 + 2x \rightarrow 72 = 2x \rightarrow x = 36°$

$\therefore \angle BAC = 36°$

iii) By the principle in (ii), we can deduce that $\angle CBA$ is also $36°$

$\therefore \angle ABF = 108 - 36 = 72°$

In $\Delta ABF \Rightarrow 72° + 36° + \angle AFB = 180°$ (Angle sum of triangle)

$\therefore \angle AFB = 72°$

Thus ΔABF is isoceles (2 of the same angles)

d) $2x - y - 3 = 0$ ①

$y = x^2 - 4x + 5$ ②

SUBSTITUTION METHOD

Take case ①

$y = 2x - 3$

Substitute into equation ②

$2x - 3 = x^2 - 4x + 5$

$x^2 - 6x + 8 = 0$

factorise

$(x-2)(x-4) = 0$

$x = 2$ OR $x = 4$

→ when $x = 2$

$2(2) - y - 3 = 0 \rightarrow y = 1$

when $x = 4$

$y = 2(4) - 3 \rightarrow y = 5$

e) $\frac{2x}{x^2+2x-3} - \frac{1}{x-1}$

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

$= \frac{2x}{(x-1)(x+3)} - \frac{1}{x-1} \times \frac{x+3}{x+3}$

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

$= \frac{2x-x-3}{(x-1)(x+3)} \Rightarrow \frac{x-3}{(x-1)(x+3)}$

Question 13.

a) $f(x) = 3x^2 - 5x + 7$

we wish to find $f(-2)$

$f(-2) = 3(-2)^2 - 5(-2) + 7$

$= 3(4) + 10 + 7$

$= 12 + 10 + 7$

$= 29$

b) $f(x) = x^2 - 3x$

$f(x+h) = (x+h)^2 - 3(x+h)$

$= x^2 + h^2 + 2hx - 3x - 3h$

$= x^2 + (2h-3)x + (h^2 - 3h)$

ii) $\frac{f(x+h) - f(x)}{h}$

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

$= \frac{2hx + h^2 - 3h}{h}$

$= 2x + h - 3$

c) $g(x) = x^2 - 4x4$

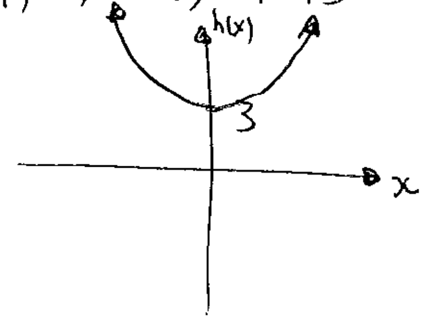
$g(-x) = (-x)^2 - 4(-x)^4$

$= x^2 - 4x4$

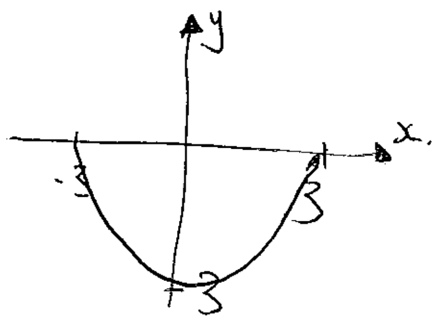
$g(-x) = g(x)$

$\therefore$ it is an even function

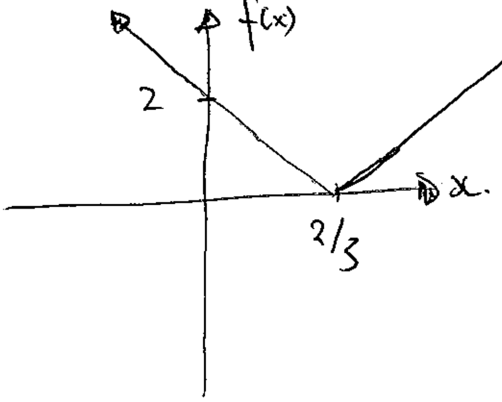
d) i) $h(x) = x^2 + 3$



ii) $y = -\sqrt{9-x^2}$



iii) $f(x) = |3x-2|$

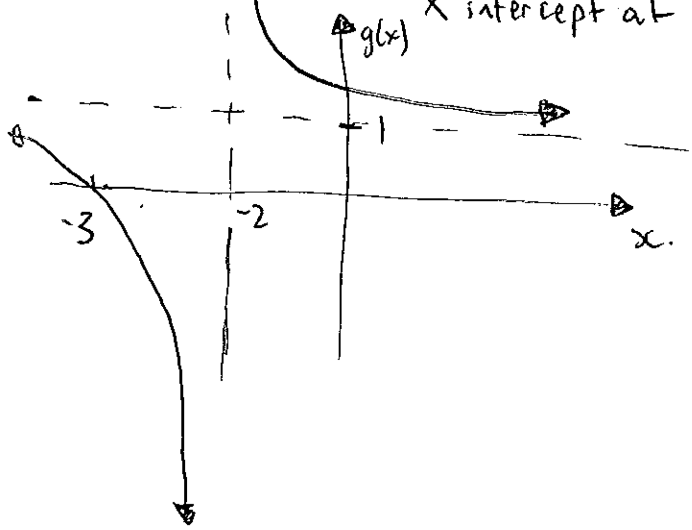


iv) $g(x) = \frac{1}{(x+2)} + 1$

Vertical asymptote at $x = -2$

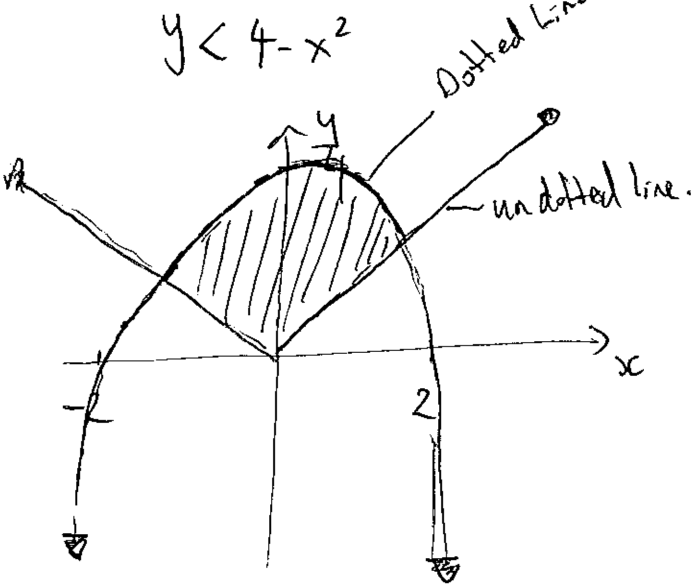
Horizontal asymptote at $g(x) = 1$

X intercept at -3



14. a) $y \geq |x|$

$y < 4 - x^2$



b) $\frac{1}{2}(a+b) \times h = A$

ii) $A = \frac{1}{2}(a+b) \times h$

$540 = \frac{1}{2}(x+36) \times 20$

$x = 18$ units

c) i) $\angle ADB = 180 - (\alpha + \beta)$
(angle sum of triangle)

$\angle ADC = 180 - [180 - (\alpha + \beta)]$
(angle sum of straight line)

$\therefore \angle ADC = \alpha + \beta$

ii) $\angle DAC = 180° - \alpha - (\alpha + \beta)$
(angle sum of ΔADC) (from i)

ie $\angle DAC = 180 - 2\alpha - \beta$ #

we can also confirm this result using ΔABC

$= 180 - \alpha - \alpha - \beta$

$= 180 - 2\alpha - \beta$ #