



Trinity Grammar School

Mathematics Department

2014

HALF-YEARLY EXAMINATION

PRELIMINARY ASSESSMENT TASK 3

Year 11

Mathematics

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using black or blue pen
- Only approved calculators for this course are allowed in this task
- Show all necessary working
- Write your Board of Studies Student Number (Year 12 HSC) or Name (Year 11) and your Class teacher on the question paper and on any answer sheets or writing booklets used to write your responses to the questions submitted
- If you do not attempt a question you must submit an answer sheet or writing booklet for that question clearly indicating **N/A** and your Student Number or Name.
- Preliminary Assessment Weighting: 30%

Board of Studies Student Number
(Year 12 only)

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Class Teacher:

.....
Name:

(Year 11 only)

.....
Do NOT write solutions on this question paper. Any working on this question paper will NOT be marked.

Date of examination:

Tuesday, 29 April 2014

Total marks – 80

Section I

10 marks

- Attempt all Questions
- Allow about **15** minutes for this section

Section II

70 marks

- Attempt all Questions
- Allow about **1** hour **45** minutes for this section

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Section I 10 marks

- Attempt Questions 1 – 10
 - Allow about 15 minutes for this section
 - Shade the correct response on the multiple-choice answer sheet for Questions 1 – 10
 - Each question is worth 1 mark
-

1 The number 23400000 expressed in scientific notation is

- (A) 2.34×10^8
- (B) 234×10^5
- (C) 2.34×10^7
- (D) 23.4×10^7

2 Express $\frac{2}{3(\sqrt{x-3})^5}$ in index notation

- (A) $2(x-3)^{-\frac{5}{3}}$
- (B) $2(x-3)^{-\frac{5}{2}}$
- (C) $\frac{2(x-3)^{\frac{5}{2}}}{3}$
- (D) $\frac{2(x-3)^{-\frac{5}{2}}}{3}$

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

(A) -2

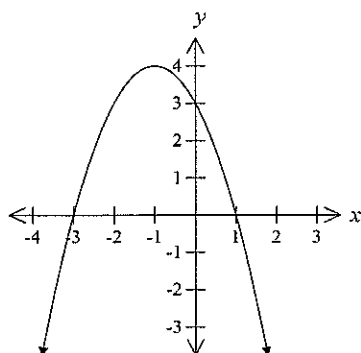
(B) -1

(C) 0

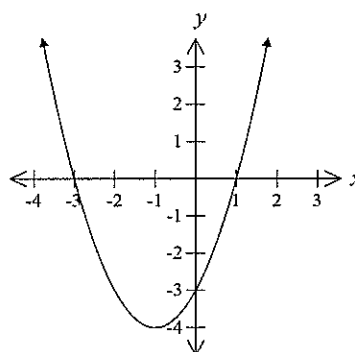
(D) 2

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

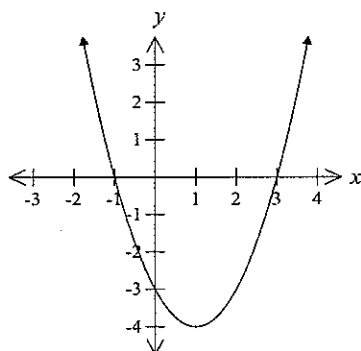
(A)



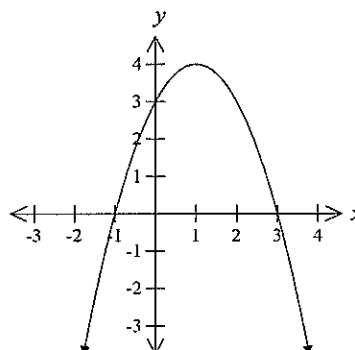
(B)



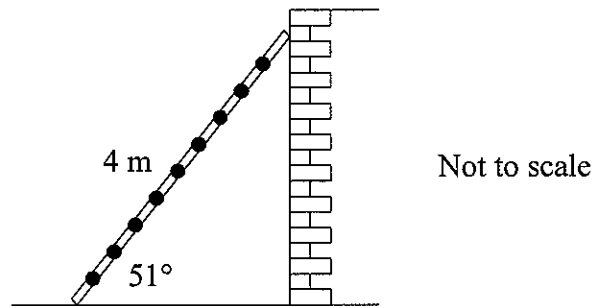
(C)



(D)



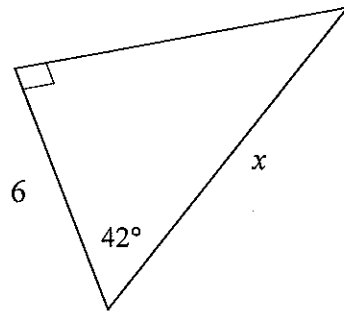
- 5 A four metre ladder reaches up a vertical wall making an angle of 51° with the ground.



How far is the foot of the ladder from the base of the wall?

- (A) 2.5m
 - (B) 3.1m
 - (C) 5.1m
 - (D) 6.4m
- 6 What is the simultaneous solution to the equations $x + y = 1$ and $3x - y = 7$?
- (A) $x = 2$ and $y = -1$
 - (B) $x = 3$ and $y = -2$
 - (C) $x = 2$ and $y = 3$
 - (D) $x = 3$ and $y = 4$

- 7 What is the value of x in the diagram?



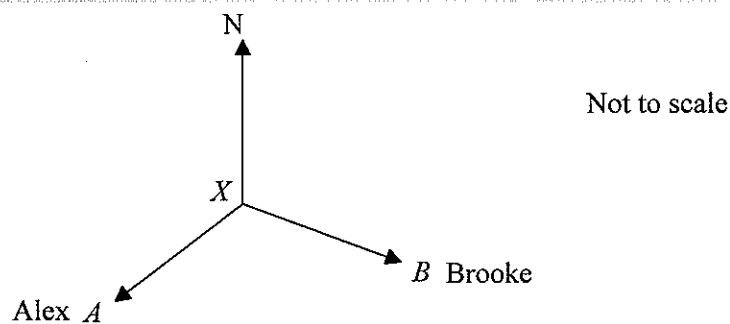
Not to scale

- (A) $6\cos 42^\circ$
(B) $\frac{6}{\cos 42^\circ}$
(C) $6\sin 42^\circ$
(D) $\frac{6}{\sin 42^\circ}$

- 8 $\frac{1}{4} + \frac{x}{8} = ?$

- (A) $\frac{1+x}{8}$
(B) $\frac{2+x}{8}$
(C) $\frac{8+x}{32}$
(D) $\frac{1+x}{12}$

- 9 Alex leaves point X and walks on a bearing of 230° . Brooke leaves point X and walks on a bearing of $S70^\circ E$.



What is the size of angle AXB ?

- (A) 300°
 - (B) 160°
 - (C) 120°
 - (D) 50°
- 10 What is the domain and range of the function $f(x) = \sqrt{9 - x^2}$?
- (A) Domain: $-3 \leq x \leq 3$, Range: $0 \leq y \leq 3$
 - (B) Domain: $-3 \leq x \leq 3$, Range: $-3 \leq y \leq 3$
 - (C) Domain: $0 \leq x \leq 9$, Range: $-9 \leq y \leq 9$
 - (D) Domain: $0 \leq x \leq 9$, Range: $0 \leq y \leq 9$

End of Section I
Section II commences on the next page

Section II 70 marks

- Attempt Questions 11 – 17
 - Allow about 1 hour and 45 minutes for this section
 - Answer each question in a SEPARATE writing booklet or answer sheet. Extra writing booklets are available.
 - In Questions 11 – 17, your responses should include all relevant mathematical reasoning and/or calculations.
-

Question 11 (10 marks)

Use a SEPARATE writing booklet

a) If $a = -1$ and $b = -2$, evaluate $\sqrt{a^3 + b^4}$ correct to 4 significant figures.

2

b) Factorise fully $x^3 - x^2 - x + 1$

2

c) Simplify $\sqrt{32} + \sqrt{128} + \sqrt{125} - \sqrt{72}$

3

d) Solve $|(x - 2)| = 3x - 1$

3

Question 12 commences on the next page.

Question 12 (10 marks)

Use a SEPARATE writing booklet

- a) A real estate agent charges 6% commission on the first \$120,000 of the value of a property sold, 2% on the next \$80,000 and 1% commission on the remaining value. Find the commission the real estate agent receives for selling a house for \$658,000.

3

- b) Evaluate $4|-5| - 2|-3| + |-5|$

1

- c) Expand and simplify $(3x^2 - 2)(2x^2 + 3)$

2

- d) Simplify $(2a^2 b^3)^3 \div (ab^2)^4$

2

- e) Factorise and simplify $\frac{x^2 - 4x - 12}{x^2 - 4}$

2

Question 13 commences on the next page.

Question 13 (10 marks)

Use a SEPARATE writing booklet

a) Find $f(2a + 1)$ when $f(x) = 4 - 3x$.

3

b) Solve $|2x - 1| \leq 7$ and graph the solution on a number line.

3

c) A plane flies north from Melbourne for 560 km, then turns and flies west for 390 km.
What is the bearing of the plane from Melbourne, correct to the nearest minute?

3

d) Find a value of x when $\sin x^\circ = \cos(x + 50^\circ)$ for $0^\circ \leq x \leq 90^\circ$

1

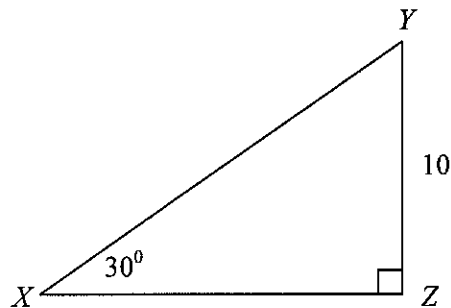
Question 14 commences on the next page.

Question 14 (10 marks)

Use a SEPARATE writing booklet

- a) Find the length of
- XY

1



- b) Find the area of triangle
- PQR
- correct to the nearest square cm if
- $\angle R = 50^\circ 55'$
- ,
- $QR = 12.1\text{cm}$
- and
- $PR = 17.6\text{ cm}$
- .

3

- c) For the function:

$$f(x) = \begin{cases} 1 - 2x & x \leq -1 \\ x + 4 & x > -1 \end{cases}$$

- i) Sketch a graph of the function, indicating the point at which the two parts of the function meet.
- ii) Find the value of $f(2) + f(-2)$.
- iii) State the domain and range of $y=f(x)$.

2

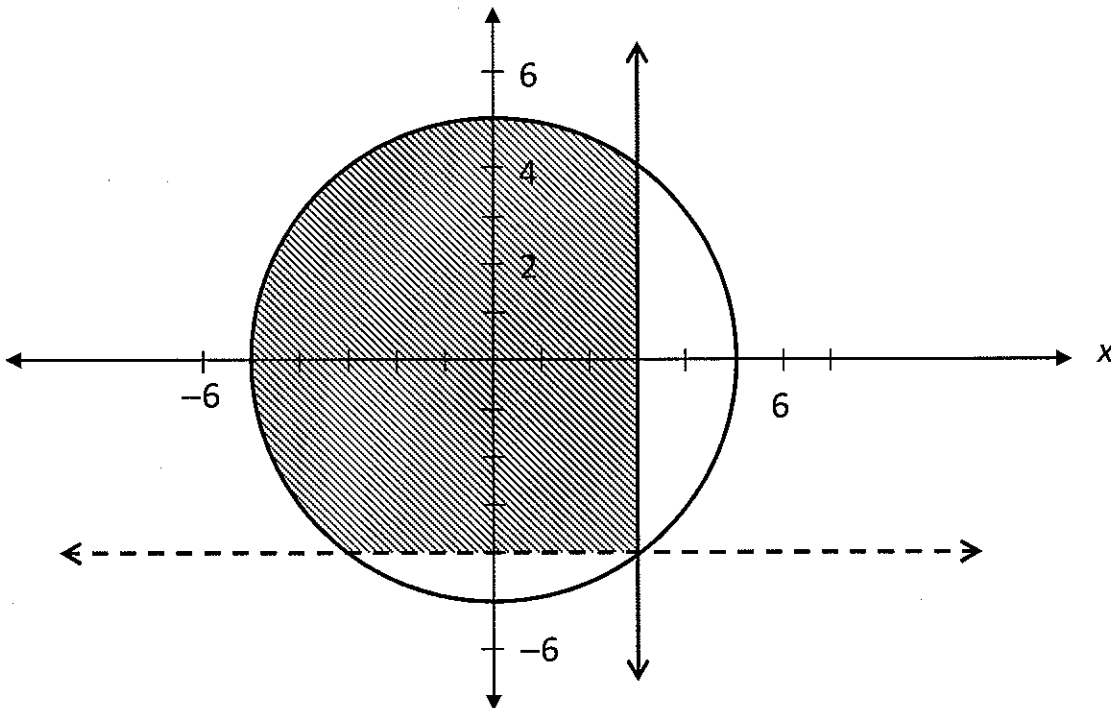
2

2

Question 15 commences on the next page.

a) State 3 inequalities that describe the shaded region in the diagram below.

3



b) Solve

i) $4x^2 - 7x - 2 = 0$

2

ii) $2^{4x+1} = 8^{x+1}$

2

c) Express $\frac{6\sqrt{3} + 3\sqrt{7}}{\sqrt{3}}$ in the form $a + b\sqrt{c}$ where a, b, c are integers.

3

Question 16 commences on the next page.

Question 16 (10 marks)

Use a SEPARATE writing booklet

a) Factorise fully

i) $18x^2 + 33x - 30$

2

ii) $8y^3 - 125$

2

b) If $\cos A = -\frac{3}{7}$ and $\tan A > 0$ find the exact value of $\sin A$ **and** $\cot A$.

3

c) Find the value of $\frac{\cot 60^\circ + \sin 30^\circ}{\sin 60^\circ}$ in simplest exact form.

3

Question 17 commences on the next page.

Question 17 (10 marks)

Use a SEPARATE writing booklet

a) Show whether the function $f(x) = 2x^2 + 1$ is odd, even or neither.

2

b) Sketch $y = \frac{1}{x+4}$ clearly indicating intercepts and asymptotes, if any.

3

c) Find the value of $\sin 420^\circ$ in exact form.

2

d) Prove $\tan^2\theta\cos^2\theta + \cot^2\theta\sin^2\theta = 1$

3

**End of Section II
End of Examination**

1. C

2. D

3. A

4. B

5. A $\cos 51 = \frac{x}{4}$

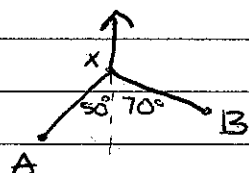
$x = 2.5$

6. A

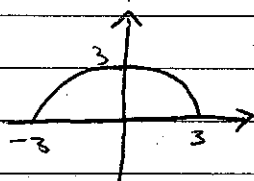
7. B $\cos 42 = \frac{6}{x}$

8. B

9. C



10. A



Q11

a) $\sqrt{a^3 + b^4} = \sqrt{-1 + 16}$

$= \sqrt{15}$

$= 3.87298 \dots$

$= 3.873$ ✓ (or ✓✓)

b) $x^3 - x^2 - x + 1$

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

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

$= (x+1)(x-1)(x-1)$ ✓ (or ✓✓)

or $(x-1)^2(x+1)$

c) $\sqrt{32} + \sqrt{128} + \sqrt{125} - \sqrt{72}$

$= 4\sqrt{2} + 8\sqrt{2} + 5\sqrt{5} - 6\sqrt{2}$ ✓

$= 6\sqrt{2} + 5\sqrt{5}$ ✓

d) $|(x-2)| = 3x-1$

$\pm (x-2) = 3x-1$

$x-2 = 3x-1$

$-2x = 1$

$x = -\frac{1}{2}$ ✓

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

$-x+2 = 3x-1$

$-4x = -3$ ✓

$x = \frac{3}{4}$

$3x-1 \geq 0$

$x \geq \frac{1}{3}$

$x = \frac{3}{4}$ ✓

Q12

a) $6\% \times 120000 + 2\% \times 80000 + 1\% \times 458000 = \13380 ✓

b) $20 - 6 + 5$

$= 19$ ✓

c) $6x^4 + 9x^2 - 4x^2 - 6$ ✓
 $= 6x^4 + 5x^2 - 6$ ✓

d) $\frac{8a^6b^9}{a^4b^8} = 8a^2b$ ✓

e) $\frac{(x+2)(x-6)}{(x+2)(x-2)}$ ✓

$= \frac{x-6}{x-2}$ ✓

Q13

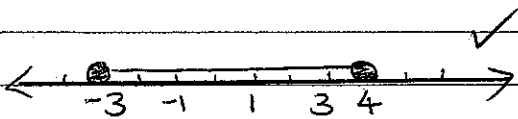
$$\begin{aligned}
 a) f(x) &= 4 - 3(2a+1) \\
 &= 4 - 6a - 3 \\
 &= 1 - 6a
 \end{aligned}$$

$$b) |2x-1| \leq 7$$

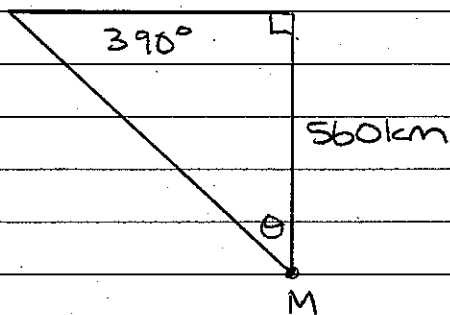
$$-7 \leq 2x-1 \leq 7$$

$$-6 \leq 2x \leq 8$$

$$-3 \leq x \leq 4$$



c)



$$\tan \theta = \frac{390}{560}$$

$$\theta = 34^\circ 51'$$

Bearing is $325^\circ 9'$

$$\begin{aligned}
 d) \sin x &= \cos(x+50) \\
 \sin \theta &= \cos(90-\theta) \\
 x &= 90 - (x+50) \\
 x &= 90 - x - 50 \\
 2x &= 40 \\
 x &= 20
 \end{aligned}$$

Q14

$$a) \sin 30 = \frac{10}{xy}$$

$$xy = \frac{10}{\sin 30}$$

$$xy = 20$$

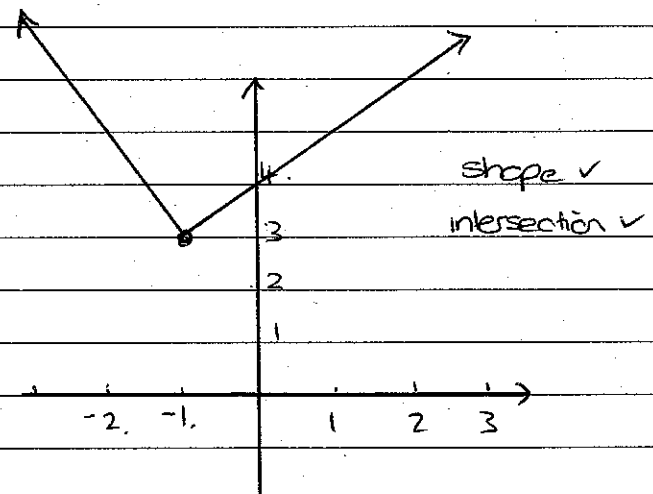
$$b) A = \frac{1}{2} ab \sin C$$

$$= \frac{1}{2} \times 17.6 \times 12.1 \times \sin 50^\circ$$

$$= 82.65 \dots$$

$$= 83 \text{ cm}^2$$

e) i)



$$ii) f(2) + f(-2)$$

$$= 2+4 + 1-2(-2)$$

$$= 11$$

$$iii) \text{Domain: all real } x$$

$$\text{Range: } y \geq 3$$

Q15

a) $x \leq 3$ ✓
 $y > -4$ ✓
 $x^2 + y^2 \leq 25$ ✓

b) i) $(4x+1)(x-2) = 0$ ✓
 $x = 2, -\frac{1}{4}$ ✓

ii) $2^{4x+1} = 8^{x+1}$
 $2^{4x+1} = 2^{3(x+1)}$ ✓

$4x+1 = 3x+3$
 $x = 2$ ✓

c) $\frac{6\sqrt{3} + 3\sqrt{7}}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$
 $= \frac{18 + 3\sqrt{21}}{3}$ ✓
 $= \frac{3(6 + \sqrt{21})}{3}$ ✓
 $= 6 + \sqrt{21}$ ✓

Q16

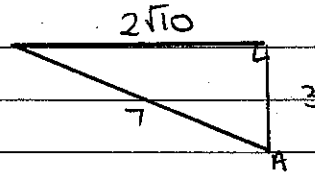
a) i) $18x^2 + 33x - 30$
 $= (9x-6)(2x+5)$ ✓
 $= 3(3x-2)(2x+5)$ ✓

ii) $8y^3 - 125$
 $= (2y-5)(4y^2 + 10y + 25)$

b) $\cos A = -\frac{3}{7}$ $\tan A > 0$

3rd Quad.

$\sin A = -\frac{2\sqrt{10}}{7}$



or $-\frac{\sqrt{40}}{7}$

$\cot A = \frac{3}{2\sqrt{10}}$

or $\frac{3}{\sqrt{40}}$ or $\frac{3\sqrt{10}}{20}$

c) $\frac{\cot 60^\circ + \sin 30^\circ}{\sin 60^\circ}$

$\cot 60^\circ = \frac{1}{\sqrt{3}}$ $\sin 30^\circ = \frac{1}{2}$ $\sin 60^\circ = \frac{\sqrt{3}}{2}$

$\frac{\frac{1}{\sqrt{3}} + \frac{1}{2}}{\frac{\sqrt{3}}{2}}$

$= \frac{2 + \sqrt{3}}{2\sqrt{3}}$
 $\frac{\sqrt{3}}{2}$

$= \frac{2(2 + \sqrt{3})}{6}$

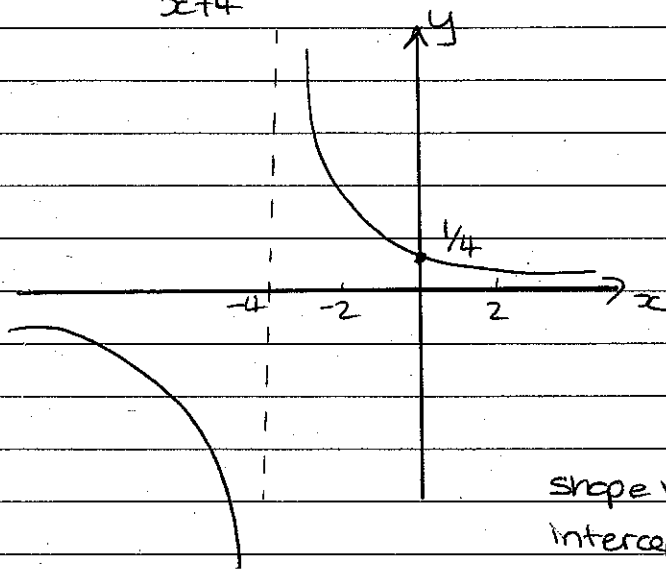
$= \frac{2 + \sqrt{3}}{3}$

Q17

$$\begin{aligned}
 \text{a) } f(x) &= 2x^2 + 1 \\
 f(-x) &= 2(-x)^2 + 1 \\
 &= 2x^2 + 1 \\
 \therefore f(-x) &= f(x)
 \end{aligned}$$

$\therefore f(x)$ is even

$$\text{b) } y = \frac{1}{x+4}$$



shape ✓
intercept ✓
asymptote ✓

asymptote at $x = -4$
y intercept at $1/4$

$$\begin{aligned}
 \text{c) } \sin 420^\circ &= \sin (360 + 60) \checkmark \\
 &= \sin 60 \\
 &= \frac{\sqrt{3}}{2} \checkmark
 \end{aligned}$$

$$\text{d) } \tan^2 \theta \cos^2 \theta + \cot^2 \theta \sin^2 \theta = 1$$

$$\text{LHS} = \frac{\sin^2 \theta}{\cos^2 \theta} \times \cos^2 \theta + \frac{\cos^2 \theta}{\sin^2 \theta} \times \sin^2 \theta$$

$$= \sin^2 \theta + \cos^2 \theta$$

$$= 1$$

$$= \text{RHS.}$$