

BRIGIDINE COLLEGE
RANDWICK

MATHEMATICS
YEAR 11

HALF-YEARLY

2009

(TIME - 1.5 HOUR)

Directions To Candidates

- * Put your name at the top of this paper and on each of the 6 sections that are to be collected.
- * All 6 questions are to be attempted.
- * All 6 questions are of equal value.
- * All questions are to be answered on separate pages and will be collected in separate bundles at the end of this exam.
- * All necessary working should be shown in every question.
- * Full marks may not be awarded for careless or badly arranged work.

Question 1 (Start a new page)

- a. $\frac{3245}{3.5^2 + 89.2}$ (correct to 3 significant figures) 2 m
- b. Evaluate $|-3 \times 4 - 5| + |4 \times 6|$ 2 m
- c. Completely factorise
- i. $3x^2 + 11x - 4$ 2 m
- ii. $8x^3 + 27$ 2 m
- d. Express $\sqrt{32} - \sqrt{8}$ in the form $a\sqrt{b}$ and state the values of a and b. 2 m
- e. State the values for x if $(x + 2)^2 = 4$ 2 m

Question 2 (Start a new page)

- a. Express $3.\overline{65}$ (ie. 3.656565 ...) as a fraction in its simplest form. 2 m
- b. Completely simplify
- i. $2\sqrt{63} - 5\sqrt{28} - 3\sqrt{343}$ 2 m
- ii. $(x - 3)^2 - (x - 1)^2$ 2 m
- c. Solve the following equations
- i. $3x + 2 = 8$ 1 m
- ii. $\frac{3x - 2}{6} - \frac{1}{3} = 4$ 2 m
- iii. $x(x + 7) + 4(x + 7) = 96$ 3 m

Question 3 (Start a new page)

a. Completely simplify

i. $\frac{x^2 - 9}{x^2 - x - 12} \times \frac{x^2 - 9x + 20}{x^2 - 3x}$ 3 m

ii. $\frac{5}{a^2 - 3a - 4} - \frac{3}{a^2 - a - 2}$ 3 m

b. Solve for x if $\left| \frac{4x + 2}{5} \right| \leq 2$ 3 m

c. Solve the following simultaneous equations

$x - y + 3 = 0$ and $xy = 10$ 3 m

Question 4 (start a new page)

a. Solve for x if $3x^2 + 7x + 2 \leq 0$ 3 m

b. On separate diagrams, sketch the following curves, you must indicate all features that assisted your sketch (tables are not suitable).

i. $y = x^2 + 4x + 3$ 2 m

ii. $y = \frac{1}{x - 2} + 1$ 2 m

iii. $y = |x + 1| - 2$ 2 m

iv. $x^2 + y^2 + 2y - 3 = 0$ 3 m

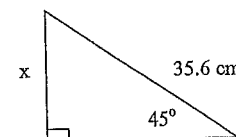
Question 5 (start a new page)

a. Find the value of θ if $\sin \theta = \frac{1}{2}$ and θ is obtuse. 2 m

b. If $\sin \alpha = \frac{3}{5}$ and α is obtuse, determine the value of $\cos \alpha$. 2 m

c. For this figure to the right,

determine the exact value of x.

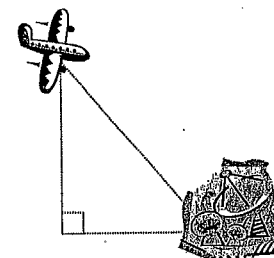


d. Find the exact value of $\tan 300^\circ$. 2 m

e. An aircraft 1000 m above sea level sights a radar station at an angle of depression of 25° .

i. Redraw the triangle to the right onto your exam page and fill in the appropriate information.

ii. Determine the distance this aircraft is to this station to the nearest metre.



Question 6 (start a new page)

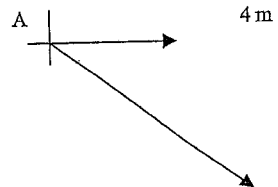
a. Find the value of θ for $0^\circ \leq \theta \leq 360^\circ$, if

i. $\sin \theta = -\frac{1}{2}$ 2 m

ii. $2 \cos \theta + \sqrt{3} = 0$ 3 m

b. Prove that $\frac{\tan \theta}{\sec \theta - 1} - \frac{\tan \theta}{\sec \theta + 1} = 2 \cot \theta$ 3 m

c. Two ships sail from a starting point A.
One sails at a speed of 20 km/hr due east
and the other sails at 30 km/hr on a
bearing of 163° .



i. Redraw this figure onto your exam page
and mark in all relevant information. 1 m

i. How far apart are the ships in two hours time (nearest km)? 3 m

RE HY '09

Q1

a) $31.98 \times 2001 \checkmark$
 $32.0 \checkmark$

b) $|-3 \times 4 - 5| + |4 \times 6| \checkmark$
 $|-17| + |24| = 41 \checkmark$

c) $3x^2 + 11x - 4$ sign
i) $(3x-1)(x+4)$ on the

ii) $8x^3 + 27$ sign
 $(2x+3)(4x^2 - 6x + 9)$ on the

d) $4\sqrt{2} - 2\sqrt{2}$ $a=2 \checkmark$
 $2\sqrt{2}$ $b=2$
method 1 $2\sqrt{2} - \sqrt{8}$
 $\sqrt{8}$

e) $x+2 = \pm 2$ method
 $x=0, x=-4 \checkmark$

f) $100x = 365.6565$
 $x = 3.6565$
 $99x = 362$ method
 $x = \frac{362}{99} \approx 3.65$

g) i) $2\sqrt{63} - 5\sqrt{28} - 3\sqrt{43}$
 $2(3)\sqrt{7} - 5(2)\sqrt{7} - 3(7)\sqrt{7}$
 $= 6\sqrt{7} - 10\sqrt{7} - 21\sqrt{7}$
 $= -25\sqrt{7}$

ii) $x^2 - 6x + 9 - 2x^2 + 2x - 1$
 $-4x + 8$
 $-4(x-2)$

Exp 112 \checkmark
Smolen \checkmark

9 i) $3x = 6$
 $x = 2$

ii) $\left[\frac{3x-2}{6} - \frac{1}{3} = 4 \right] \times 6$

$3x-2 - 2 = 24$
 $3x = 28$
 $x = \frac{28}{3}$

$[x = 9\frac{2}{3}]$

iii) $x^2 + 7x + 4x + 28 - 26 = 0$

$x^2 + 11x - 68 = 0 \checkmark$

$x = \frac{-11 \pm \sqrt{121 - 4(1)(-68)}}{2}$

$= \frac{-11 \pm \sqrt{393}}{2} \checkmark$

Q3 i) $(x-3)(x+5) = (x-4)(x-5)$

ii) $\frac{5}{(a+1)(a-4)} - \frac{3}{(a+1)(a-2)}$

$= \frac{5(a-2) - 3(a-4)}{(a+1)(a-4)(a-2)}$

$= \frac{5a - 10 - 3a + 12}{(a+1)(a-4)(a-2)}$

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

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

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

PRE HY '09

3/5 $-2 \leq \frac{x+2}{5} \leq 2$

$-10 \leq x+2 \leq 10$

$-12 \leq x \leq 8$

$-3 \leq x \leq 2$

Test $-2 \leq \frac{0+2}{5} \leq 2$
 $-2 \leq \frac{2}{5} \leq 2 \checkmark$

9 $x - y + 3 = 0$ $\left[x = \frac{10}{y} \right]$

$\frac{10}{y} - y + 3 = 0 \checkmark$

$10 - y^2 + 3y = 0$

$0 = y^2 - 3y - 10$

$0 = (y+2)(y-5)$

$y = -2 \checkmark$ $y = 5 \checkmark$

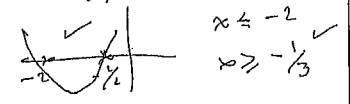
$x = -5$ $x = 2$

Q4

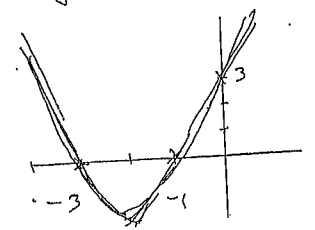
a) $3x^2 + 7x + 2 \leq 0$

$(3x+1)(x+2) \leq 0$

$x = -\frac{1}{3}, x = -2$

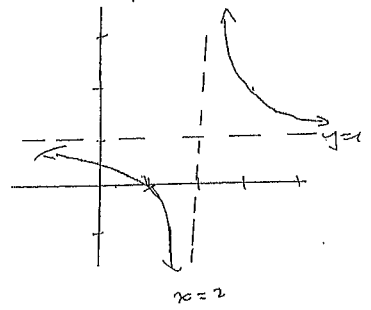


b) $y = x^2 + 4x + 3$
 $y = (x+1)(x+3)$



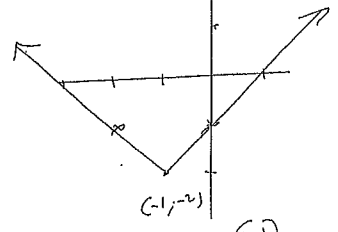
ii)

$y = \frac{1}{x-2} + 1$



iii)

$y = |x+1| - 2$



iv)

$x^2 + y^2 + 2y = 3$

$x^2 + (y+1)^2 = 4$

circle: rad 2 centre (0, -1)

Sketch

NB. Expected constants all

i) intercepts

ii) asymptotes

iii) common + intercept

iv) circle

2009 Half-Yearly HSC
Additional Comments - Marking

b. correct procedure 1 mark
only solving for positive (no additional mark)

NB Take care ..
many did not test sol'n

c. proper substitution 1 mark
answers needed to be clearly identified
ie many solved for x or y and did not
identify their complete answers

Q4

a. NB
If only factorised and stated
 $x \geq 2$ 1 m (obvious) \therefore 1 m each for
factorise / graph or a test / answer

b. Graphs
in general a poor graph only gained one
mark

i. parabola 1 mark

correct x, y intercepts 1 mark

ii. correct asymptotes 1 mark
shape 1 mark

iii. V shape 1 mark

iv. many assumed a circle
however assumed a wrong radius
only 1 m if circle had correct centre but
no working for radius

see answer sheet, however additional
comments

Q1

d. because of wording of problem
accepted $a = 1, b = 8$
 $b = \sqrt{8}$ not valid

Q2

a. method 1 mark
most gained full marks
i. first stage to simplify surd 1 mark
expansion 1 mark,
correct ans 1 mark
abuse of the negative sign
multiplication by 6 1 mark
some kept the denominator and
expansion 1 mark
solving quadratic 1 mark

Q3

a. i. correct factorisation 1 mark
abuse of cancellation no
additional marks
common denominator 1 mark
care of negative sign 1 mark
completely simplify 1 mark

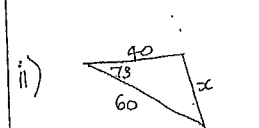
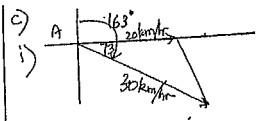
Q6 Solutions
a) i) $\sin \theta = -\frac{1}{2}$
 $\theta = -30$

$\therefore 180 + 30, 360 - 30$
 $\theta = 210^\circ, 330^\circ$

ii) $260\theta + 18 = 0$
 $\cos \theta = -\frac{18}{260}$
if $\cos \theta = \frac{18}{260}$
 $\theta = 30$

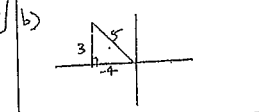
Arg: $\theta = 180 - 30, 180 + 30$
 $\theta = 150, 210^\circ$

b) $\frac{\tan \theta}{\sec \theta - 1} - \frac{\tan \theta}{\sec \theta + 1} = 2 \tan \theta$
 $\tan \theta \left[\frac{\sec \theta + 1}{\sec \theta - 1} - \frac{1}{\sec \theta + 1} \right]$
 $\tan \theta \left[\frac{\sec \theta + 1 - \sec \theta + 1}{\sec^2 \theta - 1} \right]$
 $\tan \theta \left[\frac{2}{\tan^2 \theta} \right]$
 $\frac{2}{\tan \theta}$
 $2 \tan \theta$



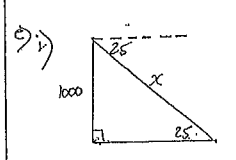
$x^2 = 40^2 + 60^2 - 2 \times 40 \times 60 \times \cos 73$
 $x^2 = 3796.61 \dots$
 $x = 61.61 \dots$
 $x = 62 \text{ km}$

Q5 a) $\sin \theta = \frac{1}{2}$
 $\theta = 30^\circ$
obuse = $180 - 30 = 150$



$\therefore \sin \alpha = \frac{3}{5}$ so $\cos \alpha = \frac{4}{5}$
9 $\sin 45 = \frac{x}{35.6}$
 $\frac{1}{\sqrt{2}} = \frac{x}{35.6} \rightarrow x = \frac{35.6}{\sqrt{2}}$

d) $\tan 300 = -\tan 60$
 $= -\sqrt{3}$



ii) $\sin 25 = \frac{1000}{x}$
 $x = \frac{1000}{\sin 25}$
 $x = 2366.20 \text{ m}$
 $x = 2366 \text{ m}$

Q5

Q6 marking scheme

a) i) 210, 330 (2 marks)
+ either answer (1 mark each)

ii) (3 marks) 150, 210
(2 marks) 150 or 210
or correct from students
simplification of wrong ans.
(1 mark) $\cos \theta = -\frac{18}{260}$

b) (3 marks) no mistakes
(2 marks) mistake
(1 mark) having $\sec^2 \theta - 1$
as denominator

c) i) see diagram

ii) (3 marks) $x = 62$
(2 marks) $x = 30.8$ (obtained
using 20, 30 as dist)
or $x^2 = 3796.61 \dots$
 $x = 11 \text{ km}$ (students used
correct numbers +
determined that
combined all numbers
before pressing cos)

(1 mark) $x^2 = 94.9 \cdot 15$
or $x^2 = 40^2 + 60^2 - 2 \times 40 \times 60 \times \cos 73$

$x = 57.38$ (assumes
right L using sin
with 40km, 60km)
 $x = 130.83$ (assumes right L
using Tan with
40km, 60km)
 $x = 44.72$ (assumes right
L using pythag
with 40km, 60km)

Q5 a) (2 marks) 150
(1 mark) 30

b) (2 marks) $-\frac{\pi}{6}$
(1 mark) getting + or -
from pythag.

c) (3 marks) $\frac{35.6}{\sqrt{2}}$

(2 marks) $\sin 45 = \frac{1}{\sqrt{2}}$

(1 mark) $\sin 45 = \frac{x}{35.6}$ or equivalent

d) (2 marks) $-\sqrt{3}$

(1 mark) $\sqrt{3}$ or $-\tan 60$

e) i) (1 mark) Diagram must
show angle of depression
and 1000m in correct place
and in part i.

ii) (2 marks) 2366 m or $x = 1103$ (found correct x but
was inside depress
horizontal
distance)
(1 mark) $x = 2145 \text{ m}$ (found
horizontal
distance)

or $\cos 25 = \frac{1000}{x}$