



Year 11 Mathematics
Assessment Task 3
June 4 2012

Name: _____

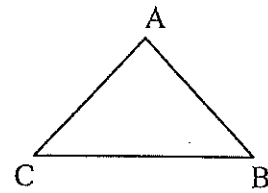
Teacher: _____

- Attempt ALL questions.
- Marks may be deducted for insufficient or illegible work.
- Only Board approved calculators (excluding graphic calculators) may be used.
- Total possible mark is 42
- Begin each question on a new sheet of paper.
- **TIME ALLOWED: 40 minutes plus 2 minutes reading time.**

Question 1 6 marks

a) Select the alternative A, B, C or D to answer questions i) to v).

i) Which expression correctly calculates the area of ΔABC ?



1

A $\frac{1}{2}ab \cos C$

B $\frac{1}{2}ab \sin C$

C $\frac{a \sin C}{b}$

D $\frac{b^2 + a^2 - c^2}{2ab}$

ii) What are the asymptotes of the graph $y = \frac{2}{x+1}$?

1

A $x = -1, y = 0$

B $x = 2, y = 0$

C $x = 0, y = 1$

D $x = 0, y = -1$

Question 1 a) continued

iii) How many points of intersection are there for the graphs $y = 3x$ and $y = x^3$? 1

A 0

B 1

C 2

D 3

iv) When the parabola $y = x^2$ is translated 2 units to the right and 4 units up, the new equation of the parabola is? 1

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

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

C $y = (x-2)^2 + 4$

D $y = (x-4)^2 + 2$

v) Given: $f(x)$ is an odd function.
Which of the following statements correctly describes the graph of $f(x)$? 1

A It is symmetrical about the y-axis.

B It is symmetrical about the x-axis.

C It is symmetrical about the origin.

D It is symmetrical about the line $y = x$.

b) Solve the inequality $1 - 2x \leq 3$ 1

Question 2 6 marks START A NEW PAGE

- a) Given: $\cos \theta = \frac{5}{\sqrt{41}}$ and $\tan \theta$ is negative. Find the value of $\sin \theta$. 2
- b) Sketch $y = |x| + 2$, clearly showing any intercepts on the coordinate axes. 1
- c) Find the exact value of $\tan 45^\circ - \sin 60^\circ$. Write your answer as a single fraction. 2
- d) The bearing of A from B is 116° . What is the bearing of B from A? 1

Question 3 6 marks START A NEW PAGE

- a) Solve the equation $\tan \theta = -\sqrt{3}$ for $0^\circ \leq \theta \leq 360^\circ$ 2
- b) Determine algebraically whether the function $f(x) = x^2 - 1$ is odd, even or neither. 1
- c) Sketch the intersection of the regions $y \geq 2^x$, $y \leq 3$ and $x \geq 0$ on a number plane. 3

Question 4 6 marks START A NEW PAGE

- a) The equation $y = x^2 + 2x + 5$ represents a parabola.
- i) Find the equation of the axis of symmetry and hence calculate the coordinates of the vertex. 2
- ii) Sketch the parabola. 1
- iii) Explain why the equation $x^2 + 2x + 5 = 0$ has no solutions. 1
- b) Prove that $1 + \cot^2 \theta = \frac{1}{1 - \cos^2 \theta}$ 2

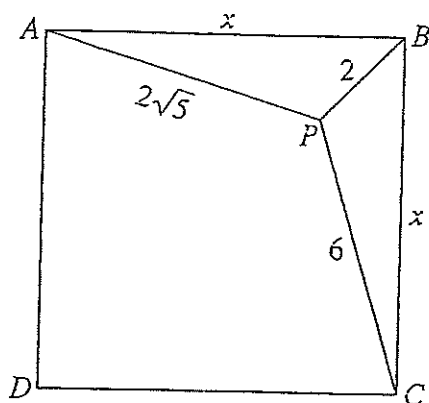
Question 5 6 marks START A NEW PAGE

- a) i) Solve $x^2 - x - 6 \geq 0$ 2
- ii) Graph the solution to part i) on a number line. 1
- b) In $\triangle ABC$, $\angle A = 40^\circ$, $a = 4\text{ cm}$ and $c = 6\text{ cm}$. What is the size of $\angle C$?
Answer to the nearest degree. 3

Question 6 6 marks START A NEW PAGE

- a) Solve $|1+x| = 3x$. 3
- b) An isosceles triangle has base angles of 30° . Using the sine rule, or otherwise, determine the ratio of the base length to the length of one of the sides? 3

Question 7 6 marks START A NEW PAGE



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The diagram shows a square ABCD of side $x\text{ cm}$, with a point P within the square, such that $PC = 6\text{ cm}$, $PB = 2\text{ cm}$ and $AP = 2\sqrt{5}\text{ cm}$. Let $\angle PBC = \theta$.

- a) Using the cosine rule in triangle PBC, show that $\cos \theta = \frac{x^2 - 32}{4x}$. 1
- b) By considering triangle PBA show that $\sin \theta = \frac{x^2 - 16}{4x}$. 1
- c) Hence, or otherwise, show that the value of x is a solution of $x^4 - 56x^2 + 640 = 0$. 2
- d) Using the substitution $m = x^2$, find all possible values of x . 2

END OF ASSESSMENT

YEAR 11 ASSESSMENT TASK 3

SOLUTIONS.

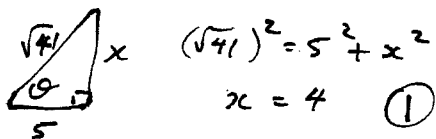
Question 1.

- a) i) B (1)
 ii) A (1)
 iii) D (1)
 iv) C (1)
 v) C (1)

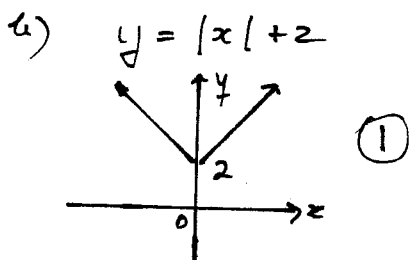
b) $-2x \leq 3$
 $-2x \leq 2$
 $x \geq -1$ (1)

Question 2.

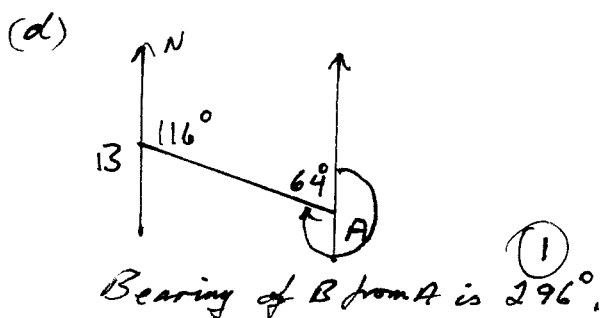
a) $\cos \theta = \frac{5}{\sqrt{41}}$, $\tan \theta < 0$



$\therefore \sin \theta = \frac{-4}{\sqrt{41}}$ (1)



(c) $\tan 45^\circ - \sin 60^\circ$
 $= 1 - \frac{\sqrt{3}}{2}$ (1)
 $= \frac{2 - \sqrt{3}}{2}$ (1)



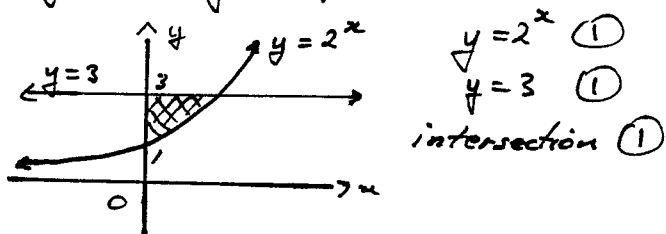
Question 3.

a) $\tan \theta = -\sqrt{3}$, $0^\circ \leq \theta < 360^\circ$
 related angle = 60° .
 $\therefore \theta = 120^\circ, 300^\circ$
 (1) (1)

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

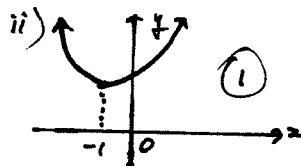
Since $f(-x) = f(x)$, $f(x)$ is even.

(c) $y \geq 2^x$, $y \leq 3$, $x \geq 0$



Question 4.

a) i) $y = x^2 + 2x + 5$
 Axis of symmetry, $x = \frac{-b}{2a}$
 $x = -1$ (1)
 Vertex $(-1, 4)$ (1)



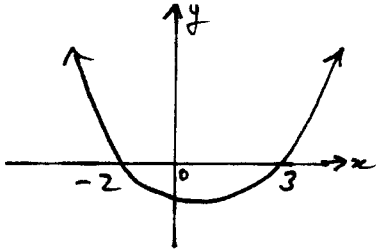
iii) $x^2 + 2x + 5 = 0$ has no solution as $y = x^2 + 2x + 5$ does not intersect the x-axis. (1)

b) $1 + \cot^2 \theta = \frac{1}{1 - \cos^2 \theta}$

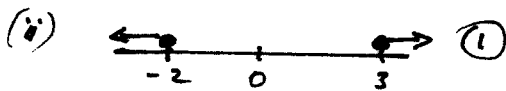
$1 + \cot^2 \theta = \csc^2 \theta$ (1)
 $= \frac{1}{\sin^2 \theta}$ (1)
 $= \frac{1}{1 - \cos^2 \theta}$

Question 5

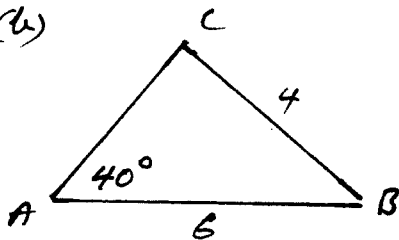
a) i) $x^2 - x - 6 \geq 0$
 $(x-3)(x+2) \geq 0$



$\therefore x \leq -2$ or $x \geq 3$
 (1) (1)



(b)



$$\frac{\sin C}{6} = \frac{\sin 40}{4} \quad (1)$$

$$\sin C = \frac{6 \sin 40}{4}$$

$$\approx 0.96418...$$

$\therefore C = 75^\circ$ or 105°
 (1) (1)

Question 6

(a) $|1+x| = 3x$

$\therefore 1+x = 3x$ or $1+x = -3x$

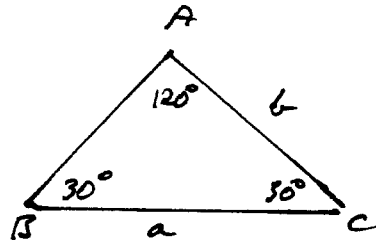
$1 = 2x$ $4x = -1$

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

Checking solutions,

$x = \frac{1}{2}$ only solution.
 (1)

(b)



$$\frac{a}{\sin A} = \frac{6}{\sin B}$$

$$\frac{a}{6} = \frac{\sin A}{\sin B} \quad (1)$$

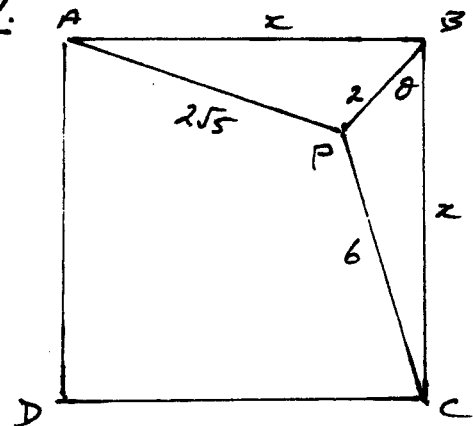
$$= \frac{\sqrt{3}/2}{1/2} \quad (1)$$

$$= \sqrt{3}$$

(1)

\therefore Length of base : length of side is $\sqrt{3} : 1$

Question 7.



a) $\cos \theta = \frac{x^2 + 2^2 - 6^2}{2 \times x \times x} = \frac{x^2 - 32}{4x}$
 (1)

b) $\angle ABP = 90 - \theta$

$$\cos(90 - \theta) = \frac{x^2 + 2^2 - (2\sqrt{5})^2}{2 \times x \times x}$$

$\therefore \sin \theta = \frac{x^2 - 16}{4x}$ (1)

(c) $\sin^2 \theta + \cos^2 \theta = 1$

$\therefore \left(\frac{x^2 - 16}{4x}\right)^2 + \left(\frac{x^2 - 32}{4x}\right)^2 = 1$ (1)

$$x^4 - 64x^2 + 1024 + x^4 - 32x^2 + 256 = 16x^2 \quad (1)$$

$$2x^4 - 112x^2 + 1280 = 0$$

$$x^4 - 56x^2 + 640 = 0$$

d) $m^2 - 56m + 640 = 0$

$(m-40)(m-16) = 0$ (1) (1)

$\therefore x^2 = 40$ or $x^2 = 16$ $\therefore x = \sqrt{40}$ or 4