FILE

NAME: _____ TEACHER: _____

SYDNEY TECHNICAL HIGH SCHOOL

MATHEMATICS

PRELIMINARY HSC Year 11

ASSESSMENT TASK 2

July 2014

Time Allowed: 70 minutes

Total Marks: 56

General Instructions:

- Each question attempted is to be started on a NEW PAGE, clearly marked with the number of the question.
- Write using black or blue pen.
- APPROVED CALCULATORS may be used.
- All necessary working should be shown. Marks may be deducted if working is poorly set out or difficult to read.

Question 1: **(7 Marks)**

a) Factorise: $8x^3$-64 /2

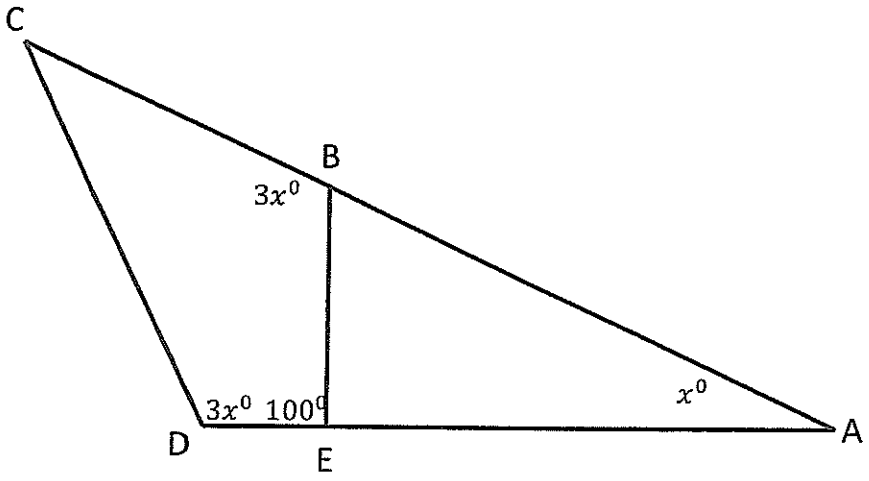
b) State the domain of: $f(x) = \frac{1}{\sqrt{9-x}}$ /2

c) Solve: $|x+3| = 2x-1$ /3

Question 2: Start a new page. **(7 Marks)**

a) Find the equation of the line parallel to
$2x - 3y + 5 = 0$, which passes through $(1, -2)$.
Give the answer in general form. /3

b)



(i) Draw this diagram in your exam booklet

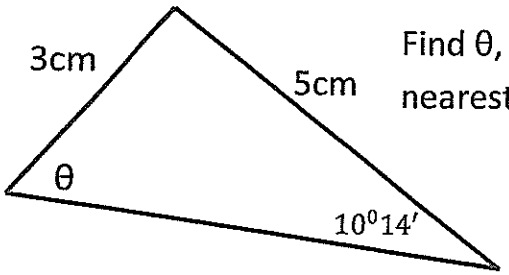
(ii) Find the size of ∠ACD, Giving reasons for your statements. /2

c) Simplify: $\frac{4^3 \times 16^{(1-3n)}}{8^{-2n}}$ /2

Question 3: Start a new page. **(7 Marks)**

a) Find the exact value of: $\sin 225^0$ /2

b)



Find θ, to the nearest minute.

Diagram Not to Scale

/3

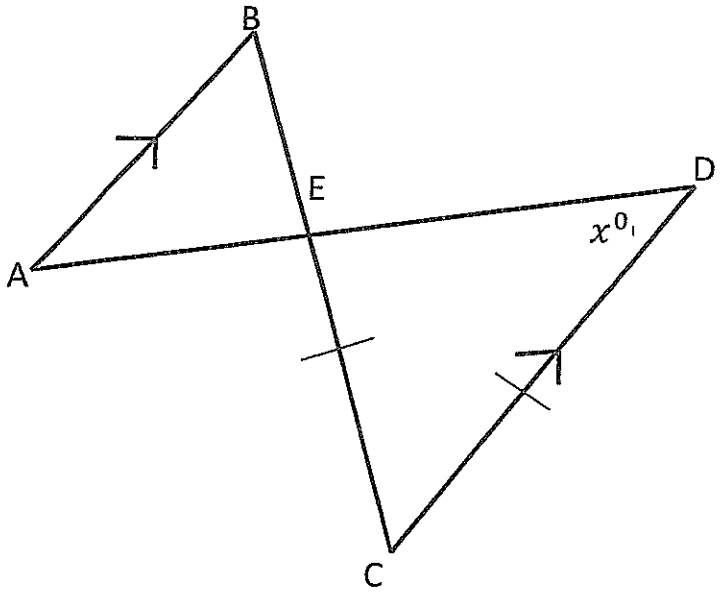
c) Solve: $\cos\theta = \frac{-\sqrt{3}}{2}$, $0^0 \leq \theta \leq 360^0$ /2

Question 4: Start a new page. **(7 Marks)**

a) If $\tan A = \frac{\sqrt{2}}{3}$, and $\cos A<0$

Find the exact value of $\sin A$ /2

b)



(i) Copy this diagram into your exam booklet /3

(ii) Prove: AB=BE

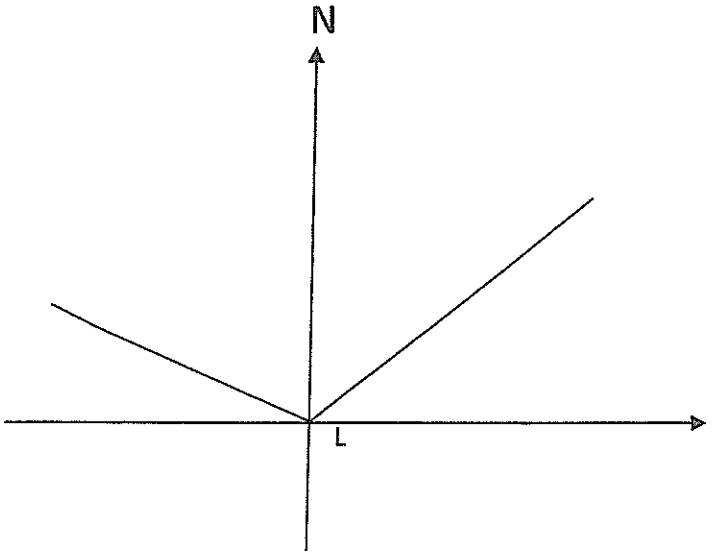
c) Prove that: $tan^2\theta cosec^2\theta = 1 + tan^2\theta$ /2

Question 5 Start a new page **(7 Marks)**

a) Simplify: $\dfrac{\sin(90-\theta)}{\sin\theta}$ /1

b) From a lighthouse, L, a ship, S, bears 053^0 T, and is at a distance of 8 nautical miles.
From L, a boat, B, bears 293^0 T and is at a distance of 6 nautical miles.

(i) Copy the diagram into your answer booklet and show all the given information.



(ii) Show that $\angle$ SLB is 120^0

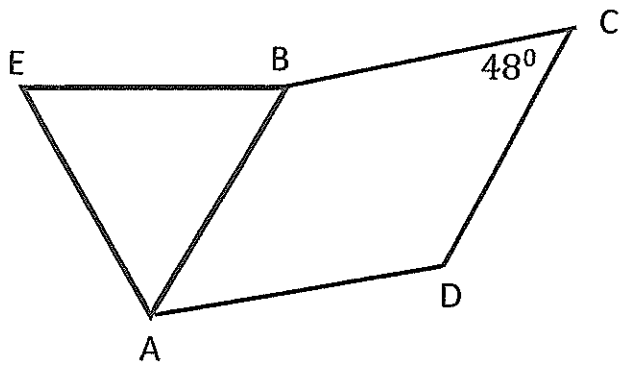
(iii) Find the exact distance of the ship from the boat, in simplest surd form.

(iv) Find the bearing of the ship from the boat to the nearest degree. /6

Question 6: Start a new page. **(7 Marks)**

a) Solve $4sin^2\theta-3=0$, $0^0\leq\theta\leq360^0$ /3

b)



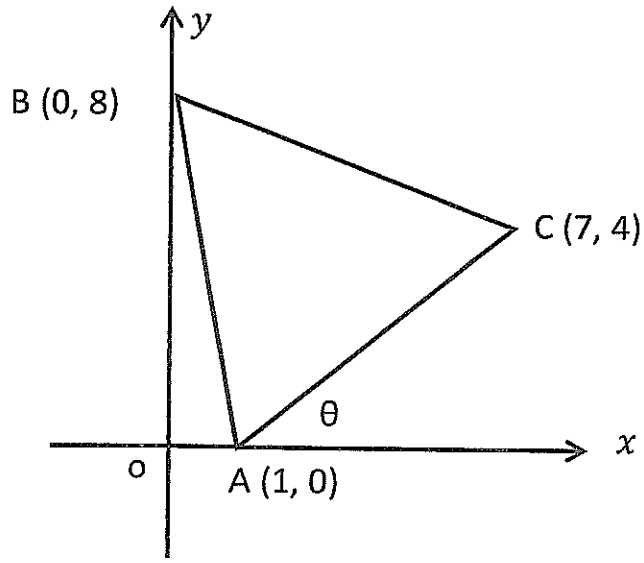
ABCD is a rhombus
$\triangle$ ABE is an equilateral triangle

(i) Draw this diagram in your exam booklet

(ii) Find the size of $\angle$EAD, giving reasons for your statement.

(iii) Find the size of $\angle$EDA giving reasons for your statement. /4

Question 7: Start a new page **(7 Marks)**



(i) Find the gradient of AC /7

(ii) Find θ to the nearest degree.

(iii) Find the co-ordinates of D, the midpoint of AC

(iv) Show that AC is perpendicular to BD

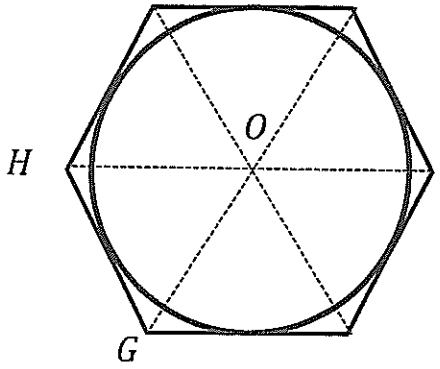
(v) What does (iv) say about $\triangle$ ABC.

(vi) Write the co-ordinates of the point E, such that ABCE is a rhombus.

Question 8: Start a new page **(7 Marks)**

a) One of the exterior angles in a regular polygon is 15^0. /1
How many sides does it have?

b)



A regular hexagon is drawn outside a circle of radius, r, centre, *O*

/6

(i) Show that $\triangle$ OGH is equilateral

(ii) Show that the area of $\triangle$ OGH is given by

$$A = \frac{\sqrt{3}r^2}{3}$$

(iii) Find the area of the hexagon in terms of r.

(iv) By considering the result in (iii)

Show that $\pi < 2\sqrt{3}$

End of Test

file

2014 Yr 11 2unit Solutions Ass 2

Question 1

a) $8x^3 - 64 = 8(x^3 - 8)$

$= 8(x-2)(x^2 + 2x + 4)$ /2

b) $x < 9$ /1

c) $|x+3| = 2x - 1$

$x + 3 = 2x - 1$

$-x = -4$

$x = 4$

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

$-x - 3 = 2x - 1$

$-3x = 2$

$x = -\frac{2}{3}$ /3

Test

$x = 4$ ✓ $x = -\frac{2}{3}$ ✗

$\therefore x = 4$

Question 2

a) $2x - 3y + 5 = 0$

$3y = 2x + 5$

$y = \frac{2}{3}x + \frac{5}{3}$

m of any line parallel is $\frac{2}{3}$ /3

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

$3y + 6 = 2x - 2$

$2x - 3y - 8 = 0$

c) $\frac{4^3 \times 16^{(1-3n)}}{8^{-2n}} = \frac{2^4 \times 2^{4-12n}}{2^{-6n}}$

$= \frac{2^{10-12n}}{2^{-6n}}$

$= 2^{10-6n}$ /2

b) $\angle ACD = 180 - 4x$ (angle sum $\triangle ACD$)

$\angle ACD = 360 - 100 - 6x$ (angle sum quad)

$180 - 4x = 260 - 6x$

$2x = 80$

$x = 40^\circ$

$\therefore \angle ACD = 180^\circ - 160^\circ$

$= 20^\circ$ /2

Question 3

a) $\sin 225^\circ = \sin(180^\circ + 45^\circ)$

$= -\sin 45^\circ$

$= -\frac{1}{\sqrt{2}}$ /2

b) $\frac{\sin\theta}{5} = \frac{\sin 10^\circ 14'}{3}$

$\sin\theta = \frac{5\sin 10^\circ 14'}{3}$

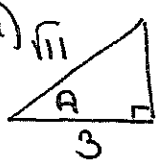
$\theta = 17^\circ 13', 162^\circ 47'$ /3

c) θ lies in quad 2 or 3

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

$= 150^\circ, 210^\circ$ /2

Question 4

a) 

A lies in quad 3

$\therefore -\sin A = \frac{-\sqrt{2}}{\sqrt{11}}$ /2

b) $\angle CED = x^\circ$ /3

(angles opp. equal sides

$\therefore \angle BEA = x^\circ$ (vertically opp angles)

$\angle BAE = x^\circ$ (alternate angles AB || DC)

$\therefore AB = BE$ (sides opp equal angles)

c) $\tan^2\theta \operatorname{cosec}^2\theta = 1 + \tan^2\theta$

LHS

$\frac{\sin^2\theta}{\cos^2\theta} \times \frac{1}{\sin^2\theta} = \frac{1}{\cos^2\theta}$

$= \sec^2\theta$

$= 1 + \tan^2\theta$

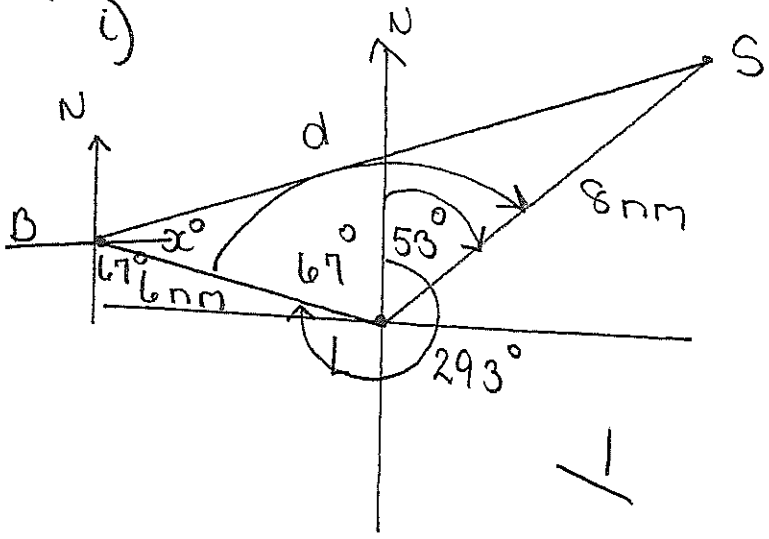
$=$ RHS /2

Question 5

a) $\cot\theta$ 1

b)

i)



1

ii) $67^\circ + 53^\circ$
$= 120^\circ$ 1

iii) $d^2 = 6^2 + 8^2 - 2\times 6\times 8\times\cos 1$

$d^2 = 148$

$d = \sqrt{148}$

$= 2\sqrt{37}$ nm 2

iv) $\frac{\sin x}{8} = \frac{\sin 120^\circ}{2\sqrt{37}}$

$x^\circ = 34^\circ 42'$

∴ bearing of ship from boat 2

$= 180^\circ - 67^\circ - 35^\circ$

$= 078^\circ T$

Question 6

a) $4\sin^2\theta = 3$

$\sin\theta = \pm\frac{\sqrt{3}}{2}$

$\theta = 60^\circ \quad 120^\circ, 240^\circ \quad 300^\circ$ 3

b)ii) $\angle BAD = 48^\circ$ (opp angles of rhombus)

$\therefore \angle EAD = 48^\circ + 60^\circ$ → (equilateral triangle) /2

$= 108^\circ$

iii) $EA = AD$ rhombus and equilateral triangle

$\therefore \triangle EAD$ is isosceles

$\therefore \angle EDA = \frac{180^\circ - 108^\circ}{2}$ (angles opposite equal sides) /2

$= 36^\circ$

Question 7

i) $m_{AC} = \frac{4}{6}$

$= \frac{2}{3}$ /1

ii) $\tan\theta = \frac{2}{3}$

$\theta = 34^\circ$ /1

iii) $D = (4, 2)$ /1

iv) $m_{BD} = \frac{8-2}{0-4}$

$= \frac{6}{-2}$

$= -\frac{3}{2}$

as $m_{BD} \times m_{AC} = -1$ /2

$AC \perp BD$

v) Isosceles /1

vi) $(8, -4)$ /1

Question 8

a) $360^\circ \div 15^\circ$

$= 24$ sides /1

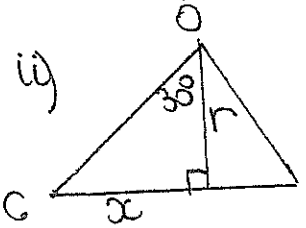
b)i) $\angle COH = 60^\circ$ regular hexagon

$OH = OC$ regular hexagon

$\therefore \angle OHC = \angle OGH = 60^\circ$ (angles opp equal sides)

$\therefore$ equilateral /2

ii)



$\tan 30^\circ = \frac{1}{\sqrt{3}}$

$\frac{1}{\sqrt{3}} = \frac{x}{r}$

$x = \frac{r}{\sqrt{3}}$

$\therefore$ area $= \frac{1}{2} \times \frac{2r}{\sqrt{3}} \times r = \frac{\sqrt{3}r^2}{3}$ /2

iii) area of hexagon

$= 6 \times \frac{\sqrt{3}r^2}{3}$

$= 2\sqrt{3}r^2$ ✓1

iv) area of circle < area of hexagon

$\pi r^2 < 2\sqrt{3}r^2$

$\pi < 2\sqrt{3}$ ✓1