SYDNEY TECHNICAL HIGH SCHOOL

MATHEMATICS

Year 11 ASSESSMENT TASK 2

JULY 2012

General Instructions

- Working Time – 65 minutes
- Approved calculators may be used.
- All necessary working should be shown for every question.
- Begin each question on a new side of the answer booklet.
- Marks may be not be awarded for careless work or illegible writing.
- For questions 1-5 write answers on the multiple choice answer sheet

Total Marks	53
Section I	5 marks
Section II	48 marks

NAME_____

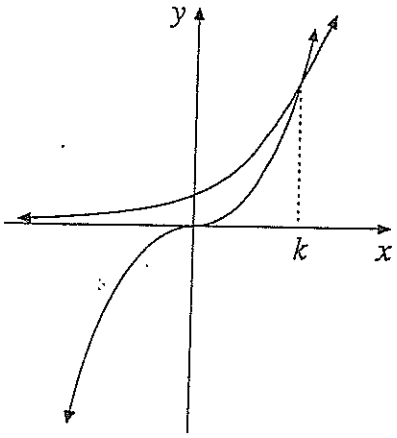
TEACHER_____

SECTION I Use the multiple choice answer sheet select the alternative A,B,C or D that best answers the question.

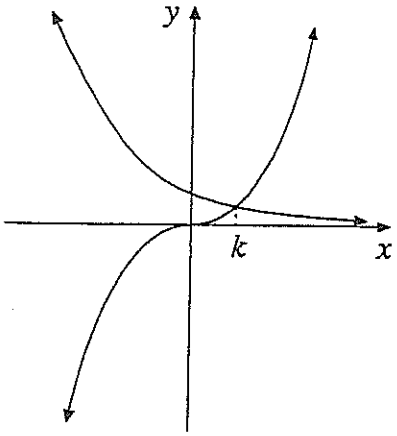
Question 1 (1 mark)

In which of the following could the value of k be a solution $2^x - x^3 = 0$?

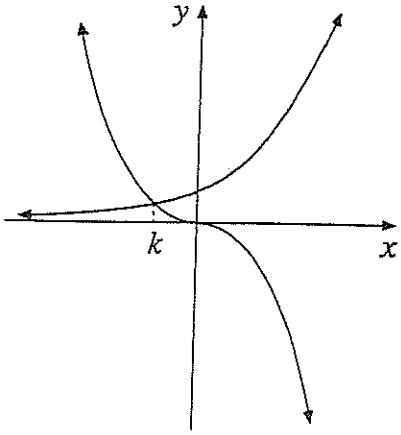
(A)



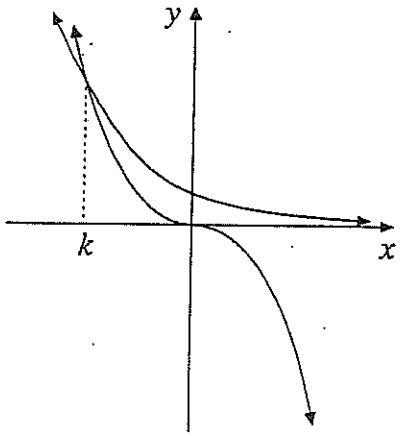
(B)



(C)



(D)



Question 2 (1 mark)

If f is defined by

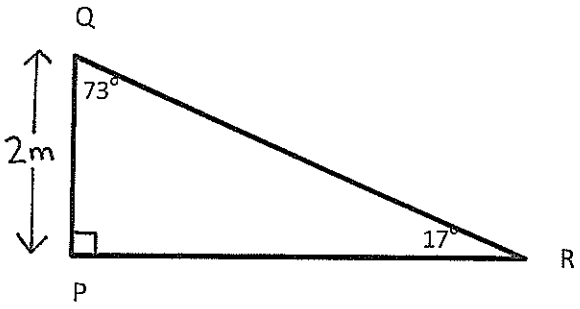
$$f(x) = \begin{cases} x+1, & \text{if } x < 3 \\ x+3, & \text{if } x \geq 3 \end{cases}$$

Find the value of $f(4) - f(2)$

(A) 2 (B) 3 (C) 4 (D) 5

Question 3 (1 mark)

PQR represents a side view of a water skiing ramp. The length RQ in metres is given by



(A) $\frac{2}{\sin 17°}$ (B) $2 \tan 17°$ (C) $2 \cos 73°$ (D) $\frac{2}{\tan 17°}$

Question 4 (1 mark)

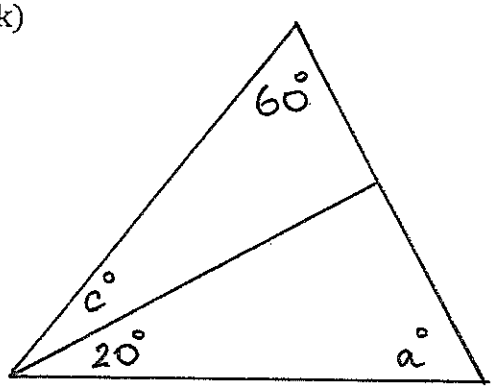
If $\tan y = 3$ and $\cos y$ is negative, then

(A) $\sin y = \frac{3}{\sqrt{10}}$ (B) $\cos y = -\frac{1}{3}$ (C) $\tan^2 y = \sqrt{3}$

(D) $\sin y = -\frac{3\sqrt{10}}{10}$

Question 5 (1 mark)

not to scale



The value of a in terms of c is

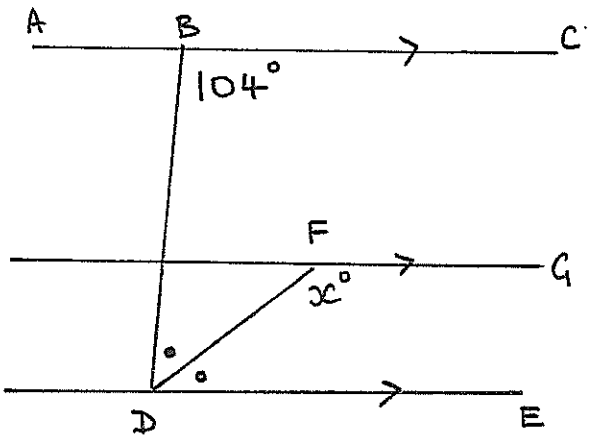
(A) $\frac{c}{2}$ (B) $c - 20$ (C) $100 - c$ (D) $80 - c$

SECTION II Attempt all questions, starting each question on a new page

Question 6 (6 marks)

a) Find the value of x (give full reasons) 3

not to scale



$\angle BDF = \angle FDE$

$AC \parallel FG \parallel DE$

b) Find the exact values of

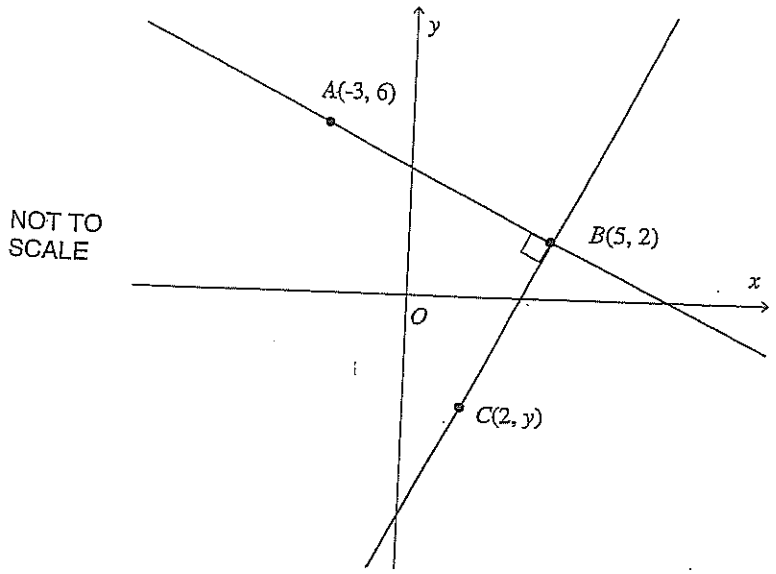
i. $\sin(-45°)$ 1

ii. $\sec 330°$ 1

iii. $\tan 420°$ 1

Question 7 (12 marks) **(Start on a new page)**

a)



The diagram shows the origin O and the points $A(-3,6)$, $B(5, 2)$ and $C(2, y)$.

The lines AB and BC are perpendicular

Copy this diagram onto your writing sheet.

i. Show that A and B lie on the line $x + 2y = 9$ **2**

ii. Show that the length of AB is $4\sqrt{5}$ units **1**

iii. Find the perpendicular distance from O to AB **2**

iv. Find the area of triangle AOB **1**

v. The equation of line CB is $2x - y - 8 = 0$
Find the co-ordinates of point C **1**

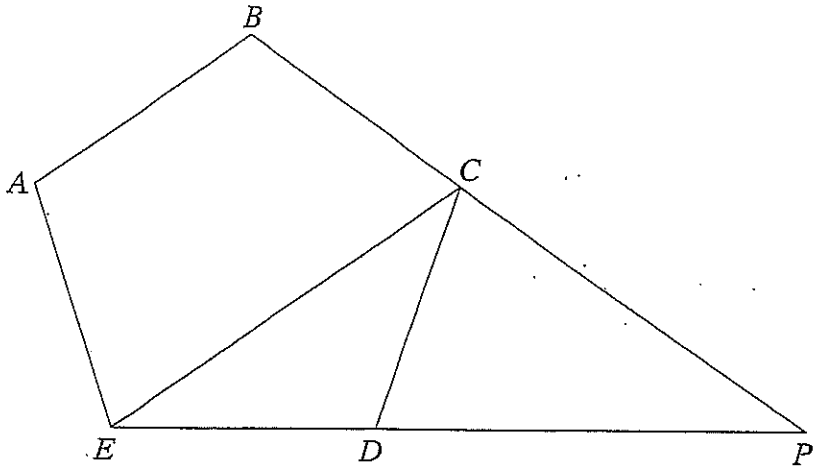
vi. The point D is not shown on the diagram. The point D lies on the x axis and $ABCD$ is a rectangle. Find the coordinates of D. **1**

vii. On your diagram, shade the region satisfying the inequalities $x + 2y \geq 9$. and $x \geq 0$ **2**

b) The point M(3,5) is the mid-point of the interval AB where A is the point (-1,2). Find the co-ordinates of B **2**

Question 8 (6 marks) **(Start on a new page)**

a) The diagram shows a regular pentagon *ABCDE.* Sides *ED* and *BC* produced



Copy or trace the diagram into your writing booklet.

i. Find the size of $\angle CDE$ **1**

ii. Hence, show that ΔEPC is isosceles (reasons required) **2**

b) i. Sketch $y = |x + 2|$ and $y = \frac{1}{3}x + 2$ on the same axes. **2**
Indicate where they cross the x and y axes.

ii. Hence solve $|x + 2| > \frac{1}{3}x + 2$ **1**

Question 9 (6 marks) **(Start on a new page)**

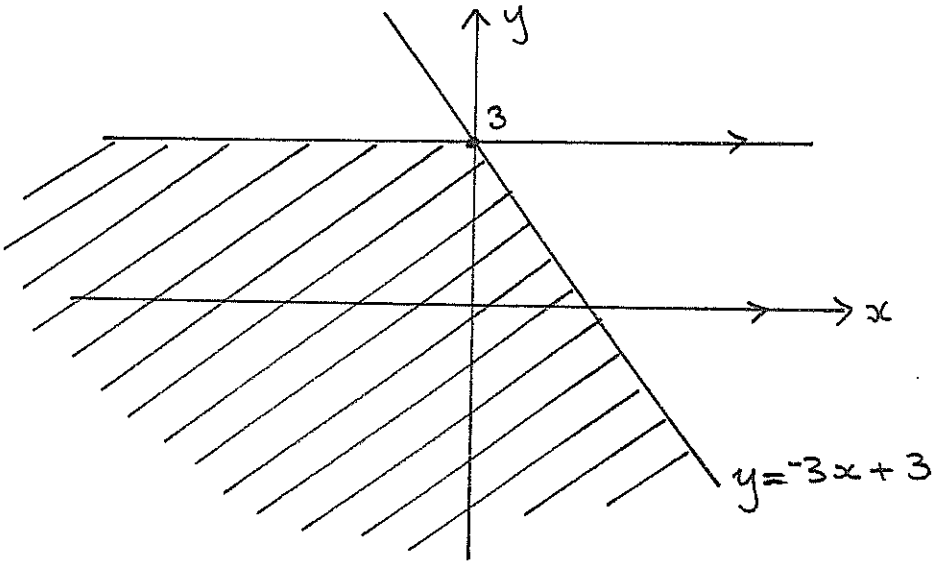
a) Solve $\sin\theta = \frac{-1}{2}$ if $0 \leq \theta \leq 360°$ **2**

b) Simplify $(\text{cosec}\theta - \cot\theta)(\text{cosec}\theta + \cot\theta)$ **2**

c) Find the length of the diagonal of a rectangle, if it makes and angle of **2**
$63° 30'$ with the shorter side, which is 4.5cm in length.
(answer correct 1 dec. p1)

Question 10 (6 marks) **(Start on a new page)**

a) Write a pair of inequalities that describe the shaded region 2



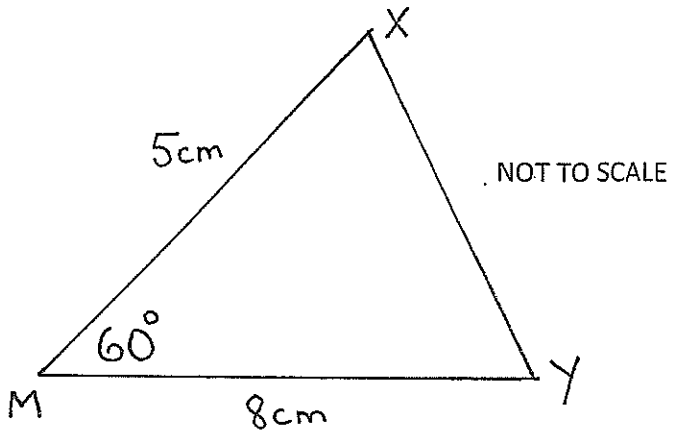
b) i Find the vertical asymptote for the function $y = \frac{4}{x-2}$ 1

ii Sketch the function (use a ruler). Show all important features 2
Find and label any points where the curve cuts the x or y axes.

iii State the range of this function 1

Question 11 (6 marks) **(Start on a new page)**

a) Find the exact area of the triangle MXY 2



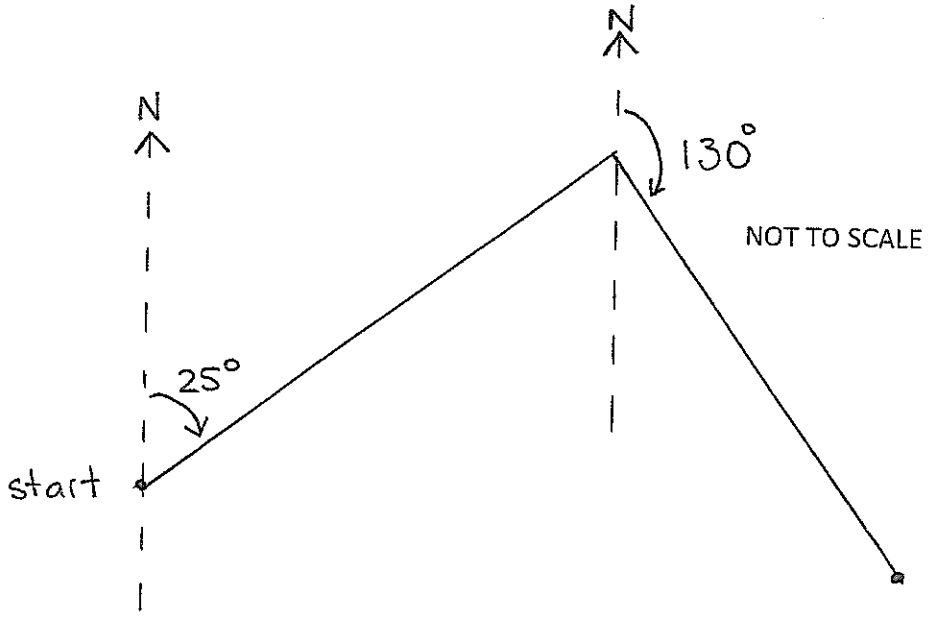
b) A helicopter flies 45km on a bearing of 025°.

It then flies 56km on a bearing of 130°.

i Show its distance from the starting point is 62km (to nearest km) **2**

ii What bearing needs to be taken to return to its starting point? **2**

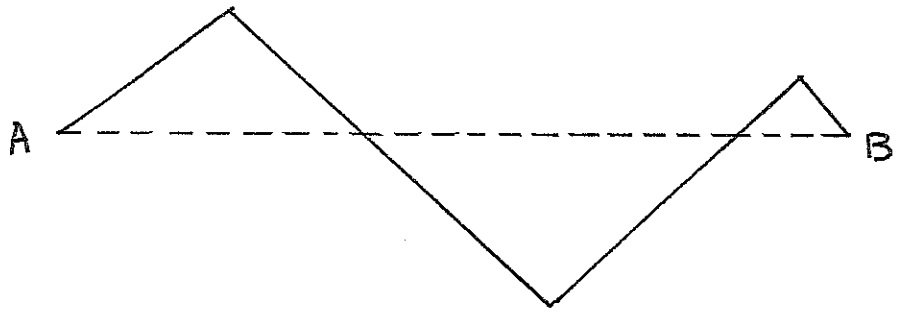
Give your answer correct to the nearest degree.



Question 12 (6 marks) **(Start on a new page)**

a) Prove $\frac{1}{\sin\theta.\ \cos\theta} - \tan\theta = \cot\theta$ 3

b) A sailing vessel sets a course alternating between N60°E and S60°W. E 3
What is the distance between two points A and B, if the ship sails 4000m.
(answer to nearest metre)



NOT TO SCALE

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Question 1 A

Question 2 C

Question 3 A

Question 4 D

Question 5 C

Question 6

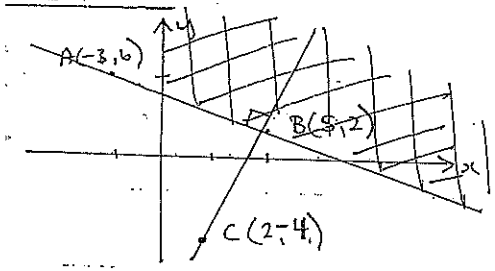
a) $\hat{BDE} = 76°$ (cointerior angles AC // DE)
$\hat{FDE} = 38°$ ($\hat{BDE}$ bisected)
$\therefore x = 142°$ (cointerior angles EG // DE)

b) i) $\sin(-45°) = \sin(360-45°)$
$= -\sin 45°$
$= -1/\sqrt{2}$

ii) $\sec 330° = \sec(360-30°)$
$= \sec 30°$
$= \frac{2}{\sqrt{3}}$

iii) $\tan 420° = \tan 60°$
$= \sqrt{3}$

Question 7



a) A(-3,6) sub into $x+2y=9$
i) $-3+12=9$ true
B(5,2) sub into $x+2y=9$
$5+4=9$ true
$\therefore$ A and B lie on $x+2y=9$

ii) $AB = \sqrt{(6-2)^2 + (-3-5)^2}$
$= \sqrt{16+64}$
$= \sqrt{80}$
$= 4\sqrt{5}$ units

iii) $P = \left| \frac{1x0 + 2x0 - 9}{\sqrt{1+4}} \right|$ where $x+2y-9=0$, $a=1$ $b=2$ $c=-9$
$P = \frac{9}{\sqrt{5}}$ units

iv) $\triangle AOB = \frac{1}{2} \times 4\sqrt{5} \times \frac{9}{\sqrt{5}}$
$= 18$ units

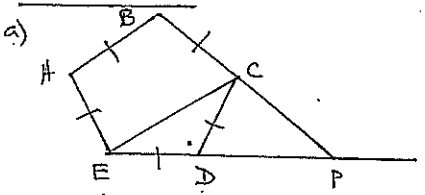
v) $y = 2x - 8$
sub $x=2$ $y = 4-8$
$y = -4$
$\therefore C(2,-4)$

vi) D $(-6,0)$

vii) See diagram

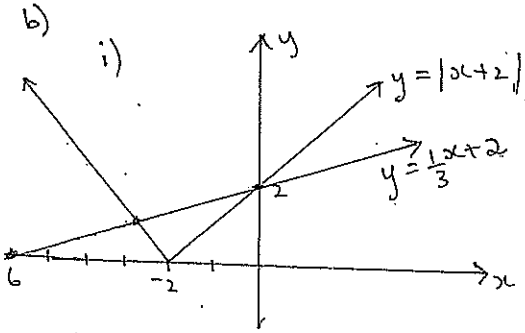
b) Let B(x,y)
$\frac{x-1}{2} = 3$ $\quad \frac{y+2}{2} = 5$
$x-1=6$ $\quad y+2=10$
$x=7$ $\quad y=8$
$\therefore B(7,8)$

Question 8

a)


i) $C\hat{D}P = \frac{360}{5} = 72°$
$\therefore C\hat{D}E = 108°$ (angles on st. line)

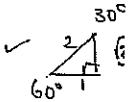
ii) $C\hat{D}P = D\hat{C}P = 72°$ (ext angle pentagon)
$\therefore C\hat{P}D = 36°$ (angle sum triangle)
$C\hat{E}D = 36°$ (ext angle of triangle is equal to sum of interior opposite angles, $\triangle EDC$ is isosceles)
$\therefore \triangle EPC$ is isosceles (2 equal angles)
$(\angle C\hat{E}D = \angle C\hat{P}D = 36°)$

b)


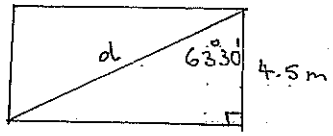
ii) Find pt intersection
$x+2 = \frac{1}{3}x+2$ & $-(x+2) = \frac{1}{3}x+2$
$0 = -\frac{2}{3}x$ $\quad -x-2 = \frac{x}{3}+2$
$x=0$ $\quad -3x-6 = x+6$
$-12 = 4x$
$x=-3$
$\therefore$ Solution $x>0$, $x<-3$

Question 9

a) $\sin\theta = -\frac{1}{2}$
acute $\theta = 30°$
$\therefore \theta = 210°, 330°$



b) $(\operatorname{cosec}\theta - \cot\theta)(\operatorname{cosec}\theta + \cot\theta)$
$= \operatorname{cosec}^2\theta - \cot^2\theta$
$= (1 + \cot^2\theta) - \cot^2\theta$
$= 1$

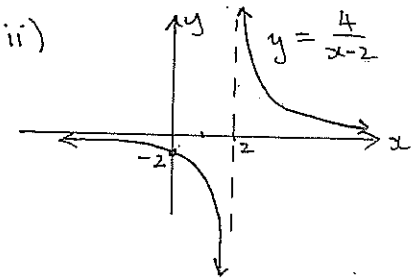
c)


$\cos 63°30' = \frac{4.5}{d}$
$d = \frac{4.5}{\cos 63°30'}$
$\therefore d = 10.1$ cm

Question 10

a) $y \leq -3x + 3$
$y \leq 3$

b) i) $x = 2$

ii)


iii) R: all real y, $y \neq 0$

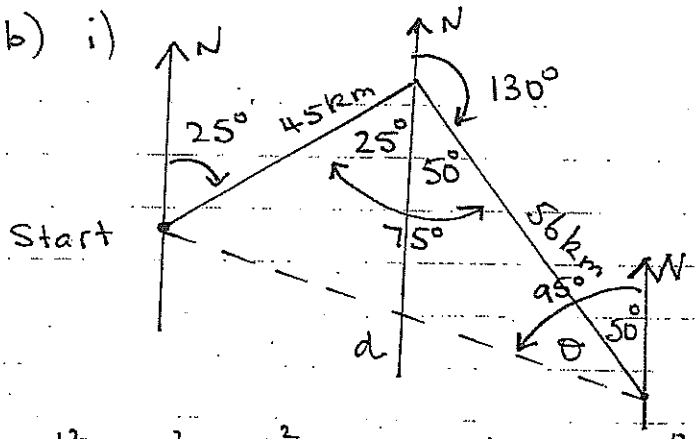
Question 11

a) $A = \frac{1}{2} \times 5 \times 8 \times \sin 60°$

$= 20 \cdot \frac{\sqrt{3}}{2}$

$A = 10\sqrt{3}$ unit^2

b) i)



$d^2 = 45^2 + 56^2 - 2 \times 45 \times 56 \times \cos 75°$

$d = 62$ km (to nearest km)

ii) $\frac{\sin\theta}{45} = \frac{\sin 75}{62}$

$\theta = 45°$

∴ Bearing S85°W OR 265°

Question 12

LHS $= \frac{1}{\sin\theta \cdot \cos\theta} - \tan\theta$

$= \frac{1}{\sin\theta \cdot \cos\theta} - \frac{\sin\theta}{\cos\theta}$

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

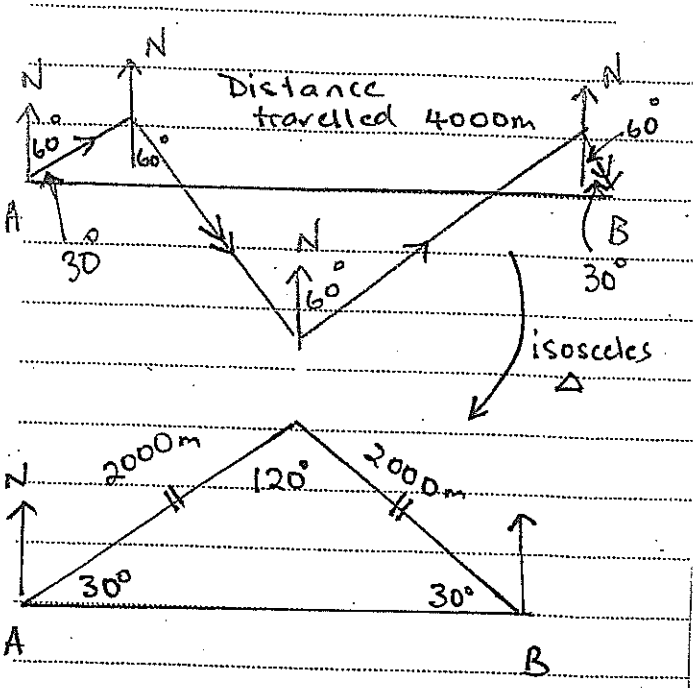
$= \frac{\cos^2\theta}{\sin\theta \cdot \cos\theta}$

$= \frac{\cos\theta}{\sin\theta}$

$= \cot\theta$

$=$ RHS

b)



∴ $AB^2 = 2000^2 + 2000^2 - 2 \times 2000 \times 2000 \times \cos 12$

∴ AB = 3464m (nearest m)