NORTH SYDNEY BOYS HIGH SCHOOL

2016 PRELIMINARY ASSESSMENT TASK 2

Mathematics

General Instructions

- Working time – 50 minutes
- Write on the lined paper in the booklet provided
- Write using blue or black pen
- Board approved calculators may be used
- All necessary working should be shown in every question
- Each new question is to be started on a **new page.**
- Marks may not be awarded for carelessly or badly arranged work.
- Attempt all questions

Class Teacher:

O Mr Zuber

Student Number:____________________________

(To be used by the exam markers only.)

Question No	1	2	3	4	Total	Total %
Mark	— 13	— 7	— 13	— 6	— 39	— 100

Question 1 (13 marks) **Marks**

(a) Find the value of θ, correct to the nearest minute, if $\cot\theta = \frac{5}{3}$, for $0° \le \theta \le 360°$. **1**

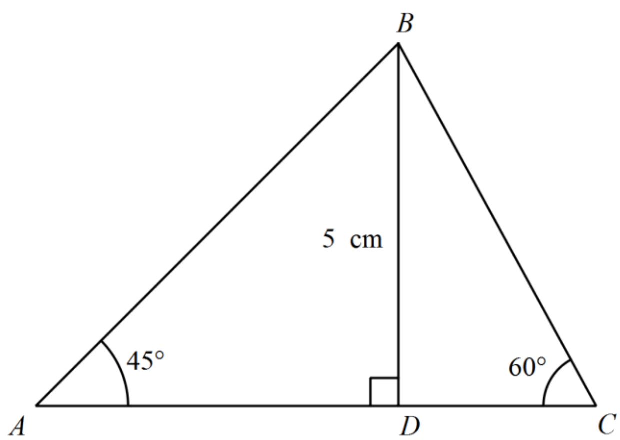
(b) If $\tan\theta = \frac{5}{11}$ and $\cos\theta$ is negative, find the exact value of $\sec\theta$. **2**

(c) Find the exact value of

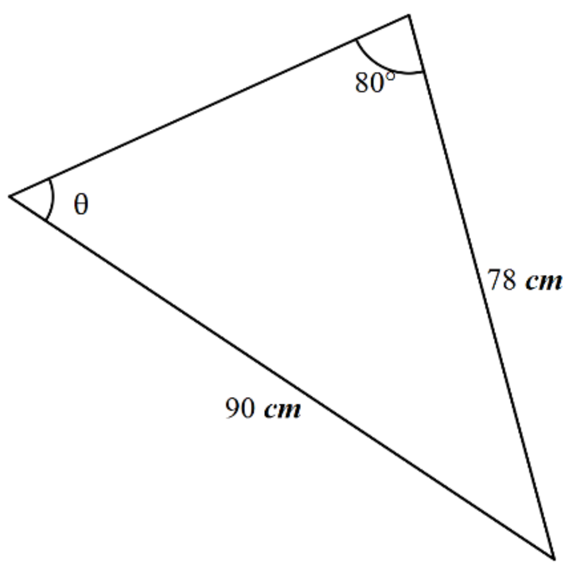
i) $3 \tan 300°$ **1**

ii) $\dfrac{2-\cos 60°}{\sec^2 135°}$ **3**

(d) Find the exact length of AC. **2**



(e)

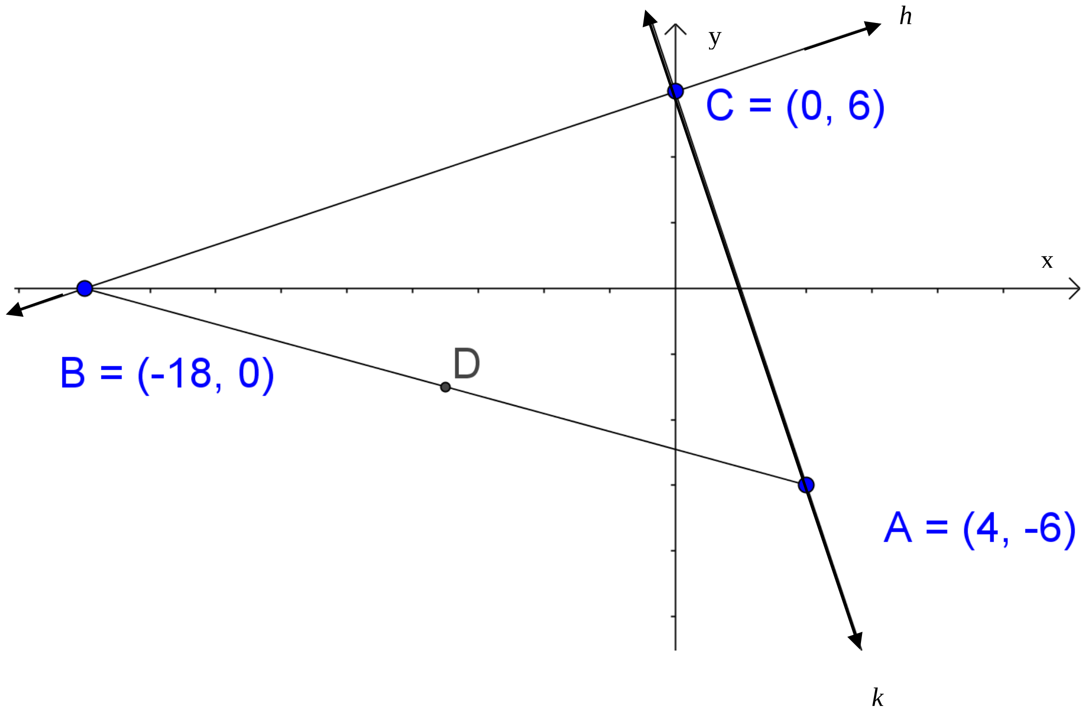


i) Find the value of θ, correct to nearest minute. **2**

ii) Find the area of the triangle, to the nearest cm^2. **2**

Question 2 (7 marks) **Marks**

In the diagram, the lines h and k are drawn. The coordinates of A, B and C are (4,-6), (-18,0) & (0,6) respectively. D is the midpoint of AB.



(a) Find the coordinate of D. **1**

(b) Find the length of AB in exact form. **1**

(c) Find the equation of the line AB in general form. **2**

(d) Find the perpendicular distance of AB from the point C, using the perpendicular distance formula $d_{\perp} = \frac{|ax_1+by_1+c|}{\sqrt{a^2+b^2}}$. **2**

(e) Hence, find the area of ΔABC. **1**

Question 3 (13 marks) **Marks**

(a) Find all values of x with $0° \leq x \leq 360°$ for which

i) $3 + 2\cos x = 5\cos x$ **2**

ii) $\operatorname{cosec}^2 x = 2$ **3**

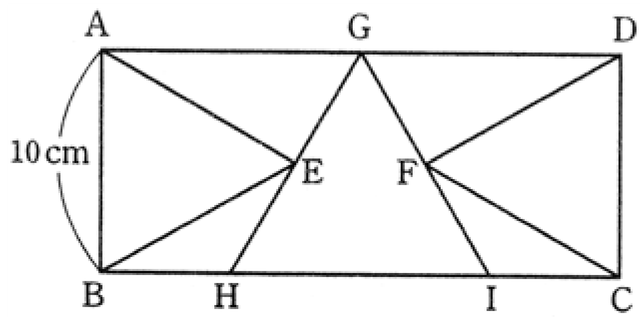
iii) $2\sin 2x = \sqrt{3}$ **4**

(b) Prove that $(1 - \tan x)^2 + (1 + \tan x)^2 = 2\sec^2 x$. **3**

Question 4 (6 marks)

(a) Sketch the curve $y = 4\sin\frac{x}{2} - 1$, for $0° \le x \le 360°$ 3

(b) The rectangle ABCD with one side of 10cm, has three equilateral triangles inside as below. $\Delta ABE \equiv \Delta CDF$, and $\Delta BHI$is an equilateral triangle but not congruent with other two triangles.



i) Prove that $\angle AEG = 90°$ 1

ii) Hence, find the length of AD. 2

\- End of examination -

2016 PRELIMINARY ASSESSMENT TASK 2 – suggested solutions

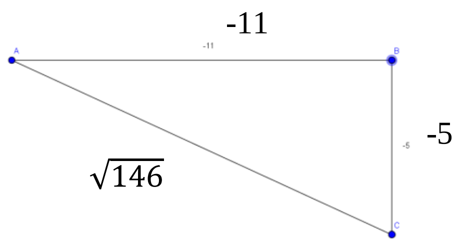
Question 1

(a) $\frac{1}{tan\theta} = \frac{5}{3}$

$tan\theta = \frac{3}{5}$, $\theta = tan^{-1}\left(\frac{3}{5}\right)$

$= 30°58'\,, 210°58'$ ✓

(b)



$sec\ \theta = \frac{hyp}{adj} = \frac{\sqrt{146}}{-11} = -\frac{\sqrt{146}}{11}$ ✓✓

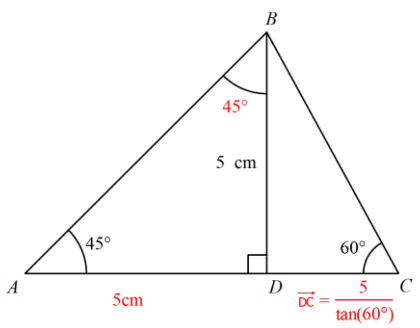
(c)

i) $3\tan 300° = 3\tan(-60°)$
$= 3 \times -\sqrt{3} = -3\sqrt{3}$ ✓

ii) $\dfrac{2-\frac{1}{2}}{\frac{1}{cos^2(180-45)}} = \dfrac{\frac{3}{2}}{\frac{1}{\left(-\frac{1}{\sqrt{2}}\right)^2}}$

$= \frac{1}{2} \times \frac{\frac{3}{2}}{1} = \frac{3}{4}$ ✓✓✓

(d)



AC$= 5 + \frac{5}{tan60} = 5 + \frac{5}{\sqrt{3}}\ or\ \frac{15+5\sqrt{3}}{3}$

✓✓

(e)

i) $\frac{sin\theta}{78} = \frac{sin80°}{90}$

$sin\theta = \frac{78 \times sin80°}{90}$

$\theta = 58°36'\,or\ \cancel{121°24'}$

But $121°24'$ is not possible as 121+80 is over 180° for angle sum of triangle! ✓✓

ii) $A = \frac{1}{2} \times 90 \times 78 \times \sin 41°24'$
$= 2321\ \text{cm}^2$ ✓✓

Question 2

(a) D = (-7,-3) ✓

(b) $AB = \sqrt{(4-(-18))^2 + (-6-(0))^2}$
$= \sqrt{520}$ units ✓

(c) $3x + 11y + 54 = 0$ ✓✓

(d) 10.52 units (2 d.p) ✓✓

(e) 239.89 units^2 (2 d.p) ✓

Question 3

(a)

i) $3 = 3\cos x$, $1 = \cos x$
$x = 0°, 360°$ ✓✓

ii) $\frac{1}{\sin^2 x} = 2$

$\sin^2 x = \frac{1}{2}$, $\sin x = \pm\frac{1}{\sqrt{2}}$

$x = 45°, 135°, 225°, 315°$ ✓✓✓

iii) $\sin 2x = \frac{\sqrt{3}}{2}$ $\quad 0° \le 2x \le 720°$

$2x = 60°, 120°, 420°, 480°$

$\therefore\ x = 30°, 60°, 210°, 240°$ ✓✓✓✓

<u>Question 3 continued</u>

(b) $(1-\tan x)^2 + (1+\tan x)^2 = 2\sec^2 x$

$LHS = \ (1-\tan x)^2 + (1+\tan x)^2$

$= 1 - 2\tan x + \tan^2 x + 1 + 2\tan x + \tan^2 x$

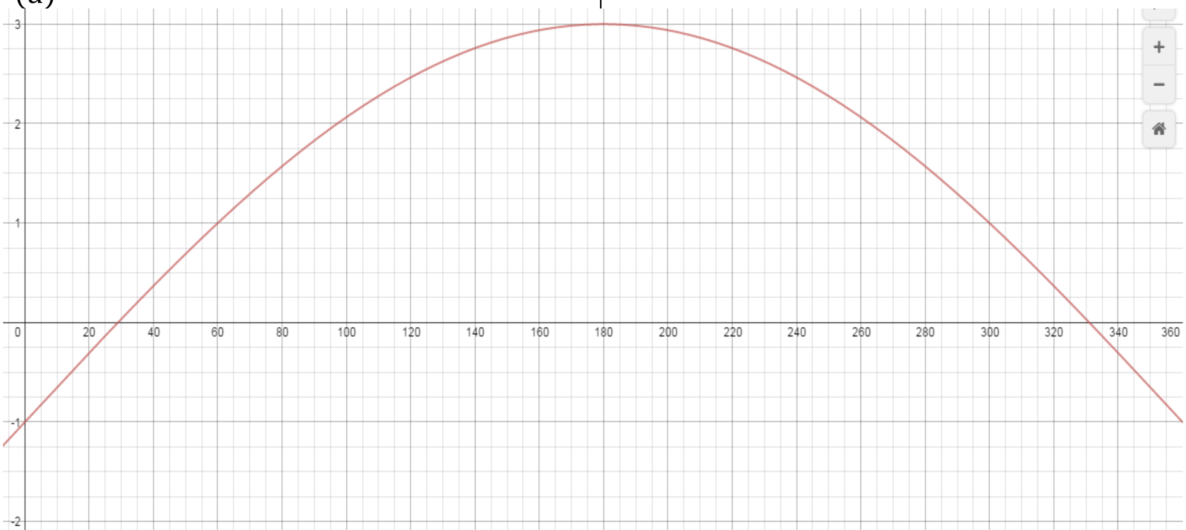
$= 2 + 2\tan^2 x = 2 + \dfrac{2\sin^2 x}{\cos^2 x}$

$\dfrac{2\cos^2 x + 2\sin^2 x}{\cos^2 x} = \dfrac{2(cos^2 x + \sin^2 x)}{\cos^2 x}$

$= \frac{2}{\cos^2 x} = 2\sec^2 x = RHS$ ✓✓✓

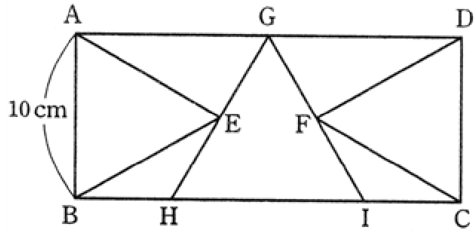
<u>Question 4</u>

(a)



Period : 720°
Range : -5 ≤ y ≤ 3
Starts at (0°,-1) ends at (360°,-1)
Maximum at (180°, 3) ✓✓✓

(b)
i)



∠EAG = 90° - 60° = 30°
∠EGA = ∠GHI = 60° (alternate angles on parallel lines)
$\therefore \angle AEG = 180° - 60° - 30°$
$(Angle\ sum\ of\ a\ triangle)$
$= 90°$ ✓
ii) AG = hypotenuse of AEG
$\cos 30° = \frac{10}{AG}, \quad AG = \frac{20}{\sqrt{3}},$

$AD = 2 \times AG = \frac{40}{\sqrt{3}} cm$ ✓✓