2016 paper 2 Q's 1, 3,4.

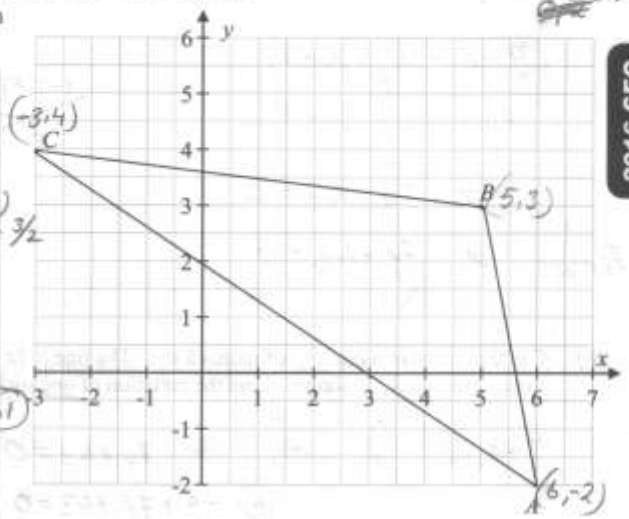
ction A **Concepts and Skills** **150 marks**

wer **all six** questions from this section.

stion 1 **(25 marks)**

points $A(6, -2)$, $B(5, 3)$ and $C(-3, 4)$ are shown on the diagram.

Find the equation of the line through B which is perpendicular to AC.



$m_{AC} = \frac{4+2}{-3-6} = \frac{6}{-9} = -\frac{2}{3}$

$m_{\perp} = 3/2$

$y - y_1 = m(x - x_1)$ (5,3) $m = 3/2$

$y - 3 = \frac{3}{2}(x - 5)$

$2y - 6 = 3x - 15$

$2y - 3x + 9 = 0$ Eqn 1

Use your answer to part **(a)** above to find the co-ordinates of the orthocentre of the triangle ABC.

Line through A ⊥ to BC

$m_{BC} = \frac{4-3}{-3-5} = \frac{1}{-8}$ $m_{\perp} = 8$ pt $(6, -2)$

$y + 2 = 8(x - 6)$

$y + 2 = 8x - 48$

$y - 8x + 50 = 0$ Eqn 2

2 Eqn 2 $2y - 16x + 100 = 0$

− Eqn 1 $-2y + 3x - 9 = 0$

$-13x + 91 = 0$

$13x = 91$

$x = 7$

orthocentre $(7, 6)$

Eqn 1 $2y - 21 + 9 = 0$

$2y = 12$

$y = 6$

0 5 10 15 (15)

Question 3 **(25 marks)**

(a) Show that $\frac{\cos 7A+\cos A}{\sin 7A-\sin A} = \cot 3A$. (Identies Bottom of Pg 15)

$\frac{\cos 7A+\cos A}{\sin 7A-\sin A} = \frac{2\cos 4A\cos 3A}{2\cos 4A\sin 3A} = \frac{\cos 3A}{\sin 3A} = \cot 3A$

Tables Pg 13

2016 SEC PAPER 2

(b) Given that $\cos 2\theta = \frac{1}{9}$, find $\cos\theta$ in the form $\pm\frac{\sqrt{a}}{b}$, where $a, b \in \mathbb{N}$. 0 3 5 8 10 (10)

$\cos 2\theta = 1/9$ ... (require an identity with $\cos 2\theta$ and $\cos\theta$ in it.]

$\cos^2 A = \frac{1}{2}(1+\cos 2A)$ Tables P 14

$\cos^2 A = \frac{1}{2}(1+1/9)$

$\cos^2 A = \frac{1}{2}(10/9)$

$\cos^2 A = 5/9$

$\cos A = \pm\sqrt{5/9}$

$\cos A = \pm\frac{\sqrt{5}}{3}$

OR

$\cos 2A = \cos^2 A - \sin^2 A$
$\cos 2A = \cos^2 A - [1-\cos^2 A]$
$\cos 2A = 2\cos^2 A - 1$
$1/9 = 2\cos^2 A - 1$
$1/9 + 1 = 2\cos^2 A$
$10/9 = 2\cos^2 A$

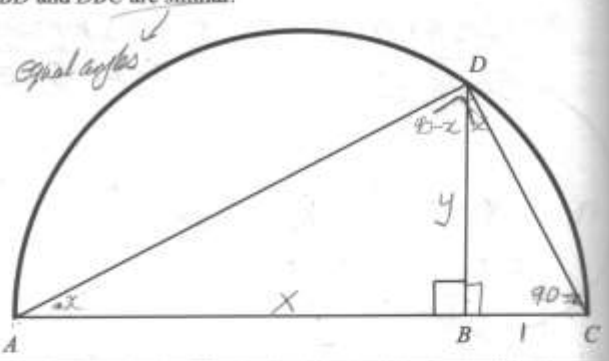
$\frac{10/9}{2} = \cos^2 A$
$5/9 = \cos^2 A$
$\pm\sqrt{5/9} = \cos A$
$\pm\frac{\sqrt{5}}{3} = \cos B$

(15) 0 5 10 15

Question 4 **(25 marks)**

The diagram shows a semi-circle standing on a diameter $[AC]$, and $[BD] \perp [AC]$.

(a) **(i)** Prove that the triangles ABD and DBC are similar.



$|\angle ABD| = |\angle CBD| = 90°$

Let $|\angle DAB| = x°$

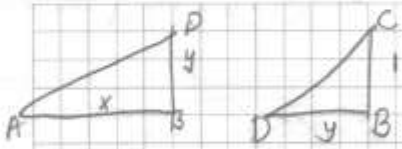
In $\triangle ADC \Rightarrow |\angle DCA| = 90 - x°$ since $|\angle ADC| = 90°$ Semicircle

also in $\triangle ADB \quad |\angle ADB| = 90° - x$

2 angles equal $\Rightarrow$ 3rd angle equal $\Rightarrow$ similar

(ii) If $|AB| = x$, $|BC| = 1$, and $|BD| = y$, write y in terms of x.

0 2 4 5 (5)



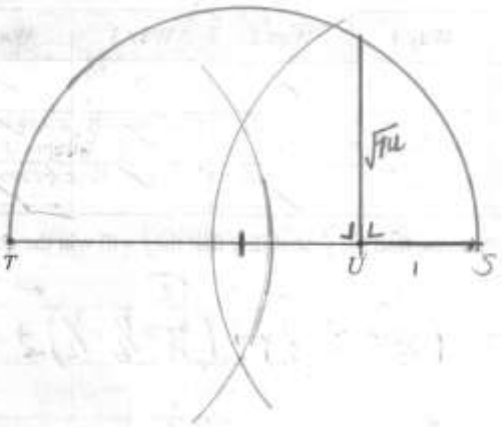
$\frac{x}{y} = \frac{y}{1}$

$x = y^2$

$\sqrt{x} = y$

(b) Use your result from part **(a)(ii)** to **construct** a line segment equal in length (in centimetres) to the square root of the length of the line segment $[TU]$ which is drawn below.

(5) 0, 2, 4, 5



- from U extend TU 1 unit to S
- Bisect line TS.
- Use mid pt to T as radius and draw a semi circle
- from U construct ⊥ line to the arc