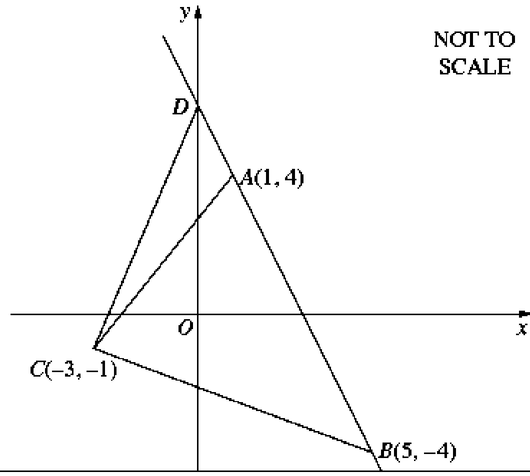
06	**3a**	In the diagram, A, B and C are the points (1, 4), (5, –4) and (–3, –1) respectively. The line AB meets the y-axis at D. (i) Show that the equation of the line AB is $2x + y - 6 = 0$. (ii) Find the coordinates of the point D. (iii) Find the perpendicular distance of the point C from the line AB. (iv) Hence, or otherwise, find the area of the triangle ADC. 	**2** **1** **1** **2**

i. Gradient $= \dfrac{y_2 - y_1}{x_2 - x_1}$ and $A(1, 4)$ and $B(5, -4)$

$= \dfrac{-4-4}{5-1}$

$= \dfrac{-8}{4}$

$= -2$

$y - y_1 = m(x - x_1)$ with (1, 4) and grad -2

$y - 4 = -2(x - 1)$

$y - 4 = -2x + 2$

$2x + y - 6 = 0$

Or, subs (1, 4) and (5, -4) into $2x + y - 6 = 0$:

subs (1, 4): $2(1) + 4 - 6 = 0$

subs (5, -4): $2(5) + (-4) - 6 = 0$

ii. As D is on y-axis, subs $x = 0$ into $2x + y - 6 = 0$:

$2(0) + y - 6 = 0$

$y = 6$ $\therefore D(0, 6)$

iii. $d = \left|\dfrac{ax_1 + by_1 + c}{\sqrt{a^2 + b^2}}\right|$ using $C(-3, -1)$ and $2x + y - 6 = 0$

$= \left|\dfrac{2(-3) + 1(-1) + (-6)}{\sqrt{2^2 + 1^2}}\right|$

$= \left|\dfrac{-13}{\sqrt{5}}\right|$

$= \dfrac{13}{\sqrt{5}}$ $\therefore$ The distance is $\dfrac{13}{\sqrt{5}}$ units

iv. $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $A(1, 4)$ & $D(0, 6)$

$= \sqrt{(0-1)^2 + (6-4)^2}$

$= \sqrt{1+4}$

$= \sqrt{5}$ $\therefore$ length of AD is $\sqrt{5}$ units

Area $= \dfrac{1}{2} \times$ base $\times$ height

$= \dfrac{1}{2} \times \sqrt{5} \times \dfrac{13}{\sqrt{5}}$

$= 6.5$ $\therefore$ area of triangle is 6.5 units^2

* These solutions have been provided by *projectmaths* and are not supplied or endorsed by the Board of Studies

Board of Studies: Notes from the Marking Centre

(i) This question was attempted in a variety of ways. The most common methods used were finding the gradient from the coordinates of A and B and then substituting into the point-gradient form of a line or substituting directly into the two-point formula. Showing the coordinates of A and B satisfied the equation of the line also earned full marks and was the most successful method used by candidates who scored few marks in other parts of the question.

(ii) Most candidates answered this part correctly. The most common mistake was to substitute $y = 0$ instead of $x = 0$ into the equation of AB to find the coordinates of D.

(iii) The perpendicular distance formula was not known by a significant number of candidates and even when it was known the substitutions were often not done correctly, with the denominator causing the most errors. Practice in using this formula correctly should be given a strong emphasis in a candidate's revision. Many students spent considerable time correctly finding the distance using other techniques.

(iv) The better responses to this question used their answer to part (iii) and the distance AD to find the area. Again, time was wasted by many candidates who did not use their answer to part (iii) to find the area of the triangle. Others incorrectly assumed that AC was perpendicular to AD or found the area of the wrong triangle. The fact that triangle ABD was an obtuse-angled triangle and the perpendicular height was measured outside the triangle appeared to confuse many candidates.

Source: http://www.boardofstudies.nsw.edu.au/hsc_exams/