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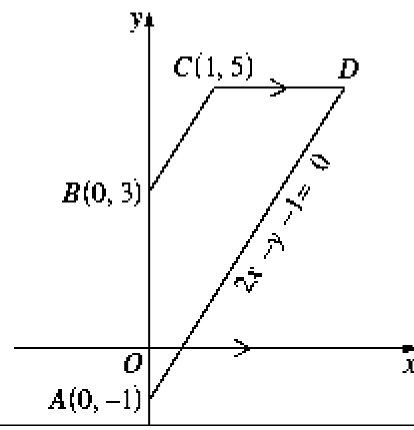
08	**3a**	In the diagram *ABCD* is a quadrilateral. The equation of the line *AD* is $2x - y - 1 = 0$. (i) Show that *ABCD* is a trapezium by showing *BC* is parallel to *AD*. (ii) The line *CD* is parallel to the *x*-axis. Find the co-ordinates of *D*. (iii) Find the length of *BC*. (iv) Show that the perpendicular distance from *B* to *AD* is $\frac{4}{\sqrt{5}}$. (v) Hence, or otherwise, find the area of the trapezium *ABCD.*	**2** **1** **1** **2** **2**



i. Gradient = $\frac{y_2 - y_1}{x_2 - x_1}$

Gradient BC = $\frac{5-3}{1-0}$

= 2

As $2x - y - 1 = 0$

then $y = 2x - 1$

gradient AD = 2

As BC || AD, ABCD is trapezium.

ii. *D* has *y* value of 5.

Subs $y = 5$ in $2x - y - 1 = 0$

$2x - 5 - 1 = 0$

$2x - 6 = 0$

$2x = 6$

$x = 3$ $\therefore D(3, 5)$

iii. $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

B(0, 3) and *C*(1, 5)

$d = \sqrt{(1-0)^2 + (5-3)^2}$

$= \sqrt{1+4}$

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

iv. $d = \left|\frac{ax_1 + by_1 + c}{\sqrt{a^2 + b^2}}\right|$ *B*(0, 3) and $2x - y - 1 = 0$

$= \left|\frac{2(0) + (-1)(3) + (-1)}{\sqrt{2^2 + (-1)^2}}\right|$

$= \left|\frac{-4}{\sqrt{5}}\right|$

$= \frac{4}{\sqrt{5}}$ $\therefore$ The distance is $\frac{4}{\sqrt{5}}$ units

v. $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

A(0, -1) and D(3, 5)

$= \sqrt{(3-0)^2 + (5-(-1))^2}$

$= \sqrt{9+36}$

$= \sqrt{45}$

$= 3\sqrt{5}$ $\therefore$ length is $3\sqrt{5}$ units

Area $= \frac{1}{2}h(a + b)$

$= \frac{1}{2} \times \frac{4}{\sqrt{5}} \times (\sqrt{5} + 3\sqrt{5})$

$= 8$

$\therefore$ The area is 8 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) In better responses, candidates successfully found the gradients of each line. Some candidates did not state a conclusion.

(ii) In better responses, candidates successfully found the coordinates of D. Incorrect solution of the equation $2x - 5 - 1 = 0$ was the most common error.

(iii) Most candidates were successful in this part.

(iv) The perpendicular distance formula was not known by a significant number of candidates. In the better responses, candidates quoted the perpendicular distance formula, showed the line of substitution without any calculation and then simplified.

(v) Successful candidates mostly used the area formula for a trapezium after finding the length AD. Others divided the area into various shapes, with the better responses providing a diagram that clearly identified those shapes.

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