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YEAR 12 – MATHEMATICS

SPECIMEN PAPER 2

TOPIC : COORDINATE GEOMETRY

AMP 2002 Q2

$A(-4,1)$, $B(0,-1)$ and $C(5,4)$ are the vertices of a triangle ABC.

(a) Show this information on a number plane. 1

(b) Find the length of AC. 2

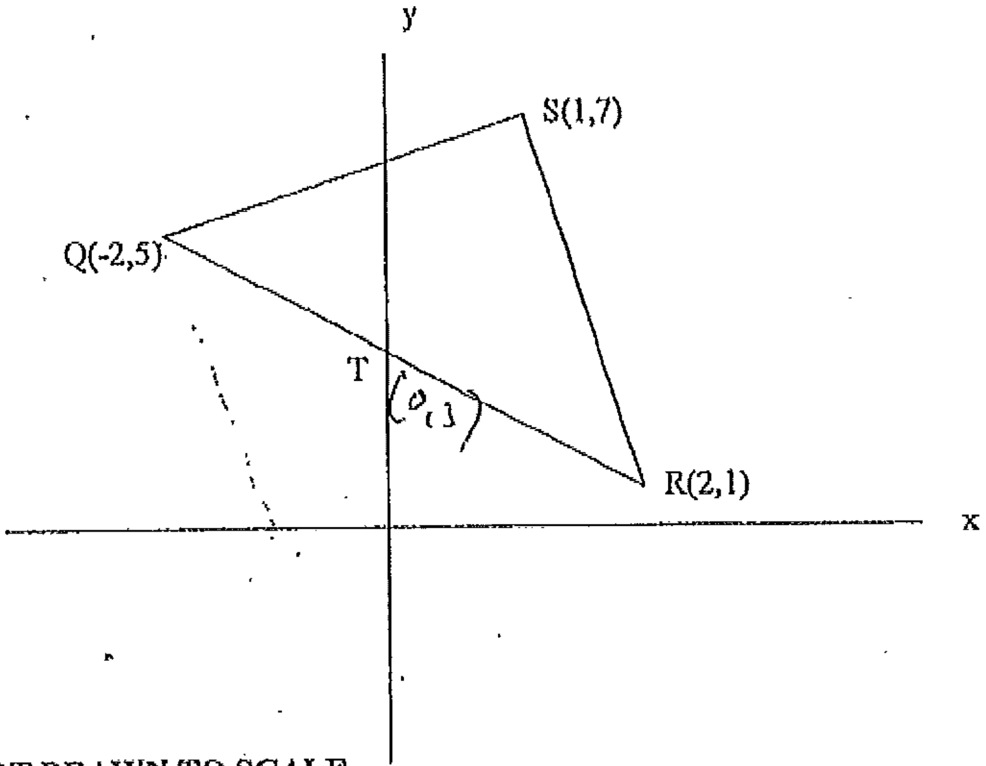
(c) Find the equation of AC in general form. **3**

(d) Calculate the perpendicular distance of B from the side AC. **2**

(e) Find the area of triangle ABC. 2

(f) Find the coordinates of D such that $ABCD$ is a parallelogram. 2

ASCHAM 2001 Q2



NOT DRAWN TO SCALE

a) Show that the equation of the line QR is $x + y - 3 = 0$. (2)

b) Find the perpendicular distance from S to QR. (2)

c) Hence find the area of triangle SQR. (2)

d) If T lies on the y axis, show that T is the midpoint of QR. (2)

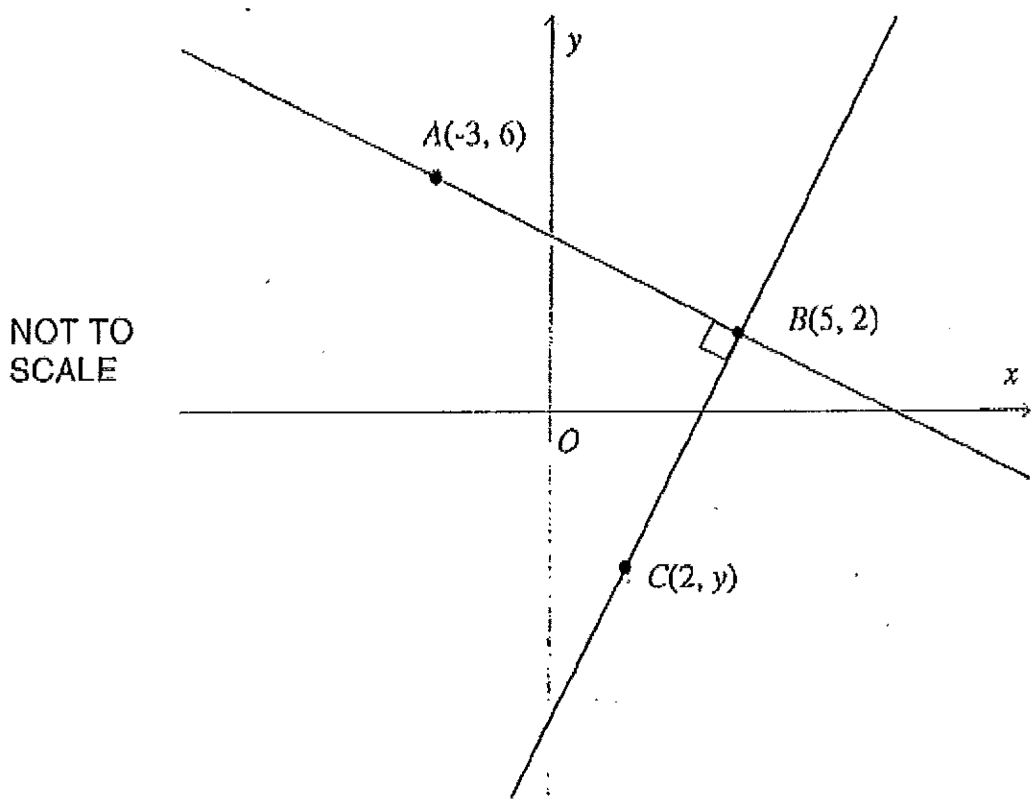
e) Find the co-ordinates of the point P such that

QPRS is a parallelogram. (1)

f) Find the equation of the circle on QR as diameter (2)

g) Shade the region defined by $x + y - 3 \geq 0$ and $x \geq 0$ (1)

CSSA 2001 Q2



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.

(a) Show that A and B lie on the line $x + 2y = 9$. 2

(b) Show that the length of AB is $4\sqrt{5}$ units. 1

(c) Find the perpendicular distance from O to AB. 1

(d) Find the area of triangle AOB. 1

(e) Show that C has coordinates (2, -4). **2**

(f) Does the line AC pass through the origin? Explain. **2**

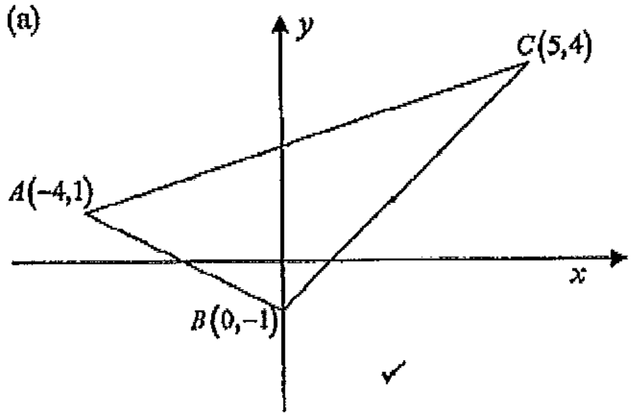
(g) The point D is not shown on the diagram. The point D lies on the x axis and $ABCD$ is a rectangle. Find the coordinates of D. 2

(h) On your diagram, shade the region satisfying the inequality $x+2y \geq 9$. 1

SOLUTIONS

AMP 2002 Q2

(a)



(b) Distance of $AC = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$

$= \sqrt{(-4-5)^2 + (1-4)^2}$ ✓

$= \sqrt{90}$ ✓

(c) Gradient of $AC = \frac{1}{3}$ ✓

$y - y_1 = m(x - x_1)$

$y - 4 = \frac{1}{3}(x-5)$ ✓

$3y - 12 = x - 5$

$0 = x - 3y + 7$ ✓

(d) Perpendicular distance

$$=\left|\frac{Ax_1+By_1+C}{\sqrt{A^2+B^2}}\right|$$

$$=\left|\frac{(1\times 0)-(3\times -1)+7}{\sqrt{1^2+(-3)^2}}\right| \checkmark$$

$$=\frac{10}{\sqrt{10}}$$
$$=\sqrt{10} \checkmark$$

(e) Area of ΔABC

$=\frac{1}{2}\times b\times h$

$=\frac{1}{2}\times\sqrt{90}\times\sqrt{10}$ ✓

$=15$ sq. units. ✓

(f) D is $(1,6)$ ✓✓

(If D is mistakenly given as $(9,2)$) ✓

ASCHAM 2001 Q2

a) $m_{QR} = \frac{1-5}{2+2}$

$= \frac{-4}{4}$ ✓

$= -1$

Eqn QR: $y - 1 = -(x-2)$

$y - 1 = -x + 2$

$x + y - 1 - 2 = 0$ ✓ (2)

$x + y - 3 = 0$

b) $pd = \frac{|ax_1 + by_1 + c|}{\sqrt{a^2+b^2}}$

$= \frac{|1+7-3|}{\sqrt{1^2+1^2}}$ ✓

$= \frac{5}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$ ✓ (2)

$= \frac{5\sqrt{2}}{2}$

c) Length of QR $= \sqrt{4^2 + (-4)^2}$ ✓

$= \sqrt{32}$

Area $= \frac{1}{2} 4\sqrt{2} \times \frac{5\sqrt{2}}{2} = 10\,u^2$ ✓ (2)

y int of $x+y-3=0$ is $(0,3)$ ✓

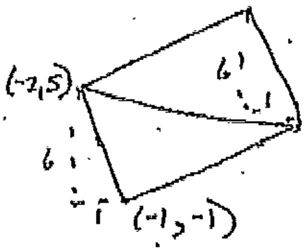
d) Midpoint of QR $= \left(\frac{-2+2}{2}, \frac{5+1}{2}\right)$

$= (0, 3)$ ✓

The pt $(0,3)$ lies on the y axis

$\therefore T(0,3)$ is the midpoint of QR. (2)

e)



∴ By comparing gradients
P is point (-1,-1)

OR using property that
diagonals bisect each other:
T is midpoint of PS

$(0,3) = \left(\frac{x+1}{2}, \frac{y+7}{2}\right)$

$\frac{x+1}{2} = 0$, $\frac{y+7}{2} = 3$

$x+1 = 0$ $\quad$ $y+7 = 6$

$x = -1$ $\quad$ $y = -1$

∴ P is (-1,-1) ✓ (1)

f) Eqn of circle:

$x^2 + (y-3)^2 = 8$ ✓ (2)

½ ½

g) Shading on diagram (1)

CSSA 2001 Q2

(a)

$x+2y=9$

Point A $(-3,6)$

test by substitution

$-3+2(6)=9$

Point B $(5,2)$

test by substitution

$5+2(2)=9$

(b)

$$\begin{aligned} AB &= \sqrt{(5--3)^2+(2-6)^2} \\ &= \sqrt{64+16} \\ &= \sqrt{80} \\ &= \sqrt{16}\times\sqrt{5} \\ &= 4\sqrt{5} \text{ units} \end{aligned}$$

(c)

$$\frac{|1(0)+2(0)-9|}{\sqrt{1^2+2^2}}$$

$$= \frac{9}{\sqrt{5}} \text{ units}$$

(d)

$$\begin{aligned} \text{Area} &= \frac{1}{2}\times 4\sqrt{5}\times\frac{9}{\sqrt{5}} \\ &= 18 \text{ units}^2 \end{aligned}$$

(e)

$$\text{gradient of } AB = \frac{2-6}{5+3}$$
$$= -\frac{1}{2}$$

gradient of BC is thus 2

since the product of the gradients of perpendicular lines is -1

$$\text{gradient of } BC = \frac{y-2}{2-5}$$
$$= \frac{y-2}{-3}$$

$$\text{Solve } \frac{y-2}{-3} = 2$$
$$y = -6+2$$

$$= -4$$

(f)

$$\text{gradient of } AO = \frac{6}{-3}$$
$$= -2$$

$$\text{gradient of } OC = \frac{-4}{2}$$
$$= -2$$

Hence AOC is a straight line and so AC passes through O

(g)

Let D have coordinates $(x,0)$

gradient of $AO \times$ gradient of $AB = -1$

$$\Rightarrow \frac{6-0}{-3-x} \times -\frac{1}{2} = -1$$
$$-6 = 6+2x$$
$$x = -6$$

$\Rightarrow D$ is the point $(-6,0)$

(h)