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MA303.1.E2 (Adv) – Coordinate Geometry Exercise

1. The image of the point $(2, 9)$, under a reflection in the line $y = 2x$, is (h, k) . Calculate the values of h and k .
2. Show that given any quadrilateral, the midpoints of the sides will always form a parallelogram.



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1. Gradient of perpendicular line $= -1 \div 2$
 $= -\frac{1}{2}$

$$y - 9 = -\frac{1}{2}(x - 2)$$

$$y = -\frac{1}{2}x + 10 \quad \text{--- ①}$$

$$y = 2x \quad \text{--- ②}$$

$$-\frac{1}{2}x + 10 = 2x$$

$$2.5x = 10$$

$$x = 4$$

Sub $x = 4$ into ②

$$\therefore y = 8$$

Distance between $(2, 9)$ and $(4, 8)$ = distance between $(4, 8)$ and (h, k)

$$= \sqrt{(2-4)^2 + (9-8)^2} \text{ units}$$

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

$(4, 8)$ is the mid point of $(2, 9)$ and (h, k)

$$h = 4 \times 2 - 2$$

$$= 6$$

$$k = 8 \times 2 - 9$$

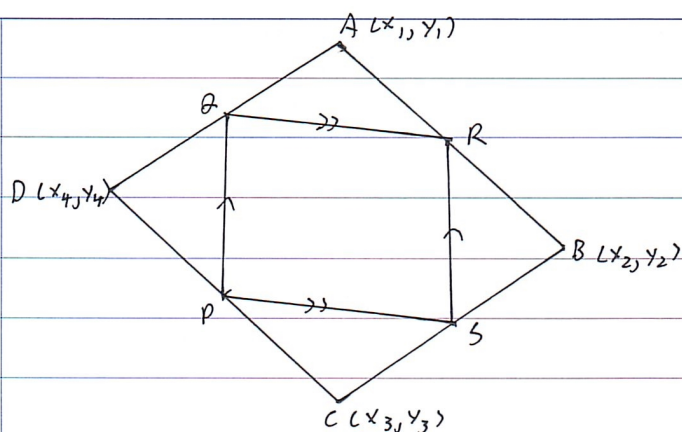
$$= 7$$

$$\therefore (h, k) = (6, 7)$$



8'887036'222215

2.



Let $ABCD$ be the quadrilateral.

Q is the midpoint of AD

R " " AB

S " " BC

P " " CD

$$Q = \left(\frac{x_1 + x_4}{2}, \frac{y_1 + y_4}{2} \right)$$

$$P = \left(\frac{x_2 + x_4}{2}, \frac{y_2 + y_4}{2} \right)$$

$$\text{Gradient of } PQ = \frac{y_1 - y_2}{x_1 - x_2}$$

$$\text{Gradient of } QR = \frac{y_2 - y_4}{x_2 - x_4}$$

$$S = \left(\frac{x_2 + x_3}{2}, \frac{y_2 + y_3}{2} \right)$$

$$R = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

$$\text{Gradient of } RS = \frac{y_1 - y_3}{x_1 - x_3}$$

$$\text{Gradient of } PS = \frac{y_2 - y_4}{x_2 - x_4}$$

As gradient of PQ = gradient of RS , they are parallel. ✓

As gradient of QR = gradient of PS , they are parallel. ✓