Student 1: Low Excellence

NZQA Intended for teacher use only

Part (a)

A (0,0) B(1,4) C(5,3) D(7,1)

A(0,0) B(1,4) $\frac{0+1}{2}=0.5$ $\frac{1+4}{2}=2$ P=(0.5,2)

B(1,4) C(5,3) $\frac{1+5}{2}=3$ $\frac{4+3}{2}=3.5$ Q=(3,3.5)

C(5,3) D(7,1) $\frac{5+7}{2}=6$ $\frac{3+1}{2}=2$ R=(6,2)

D(7,1) A(0,0) $\frac{7-0}{2}=3.5$ $\frac{1-0}{2}=0.5$ S=(3.5,0.5)

Q(3,3.5) R(6,2) $m=\frac{3.5-2}{3-6}=\frac{1.5}{-3}=-0.5$ P(0.5,2) S(3.5,0.5) $m=\frac{2-0.5}{0.5-3.5}=\frac{1.5}{-3}=-0.5$

Same gradients so these are parallel.

P(0.5,2) Q(3,3,5) $m=\frac{2-3.5}{0.5-3}=\frac{-1.5}{-2.5}=0.6$ S(3.5,0.5) R(6,2) $m=\frac{0.5-2}{3.5-6}=\frac{-1.5}{-2.5}=0.6$

Same gradients so these are parallel.

2 lots of parallel lines so the quadrilateral is a parallelogram

Part (b)

A(0,0) B(a,b) C(c,d) D(e,f)

A(0,0) B(a,b) $\frac{0+a}{2}=\frac{a}{2}$ $\frac{0+b}{2}=\frac{b}{2}$ P = $(\frac{a}{2},\frac{b}{2})$

B(a,b) C(c,d) $\frac{a+c}{2}$ $\frac{b+d}{2}$ Q = $(\frac{a+c}{2},\frac{b+d}{2})$

C(c,d) D(e,f) $\frac{c+e}{2}$ $\frac{d+f}{2}$ R = $(\frac{c+e}{2},\frac{d+f}{2})$

D(e,f) A(0,0) $\frac{e}{2}$ $\frac{f}{2}$ S = $(\frac{e}{2},\frac{f}{2})$

$m_{RS}=\frac{\frac{d+f}{2}-\frac{f}{2}}{\frac{c+e}{2}-\frac{e}{2}}=\frac{d+f-f}{c+e-e}=\frac{d}{c}$ $m_{PQ}=\frac{\frac{b+d}{2}-\frac{b}{2}}{\frac{a+c}{2}-\frac{a}{2}}=\frac{b+d-b}{a+c-a}=\frac{d}{c}$

These have the same gradients so are parallel.

$m_{PS} = \dfrac{\frac{b}{2} - \frac{f}{2}}{\frac{a}{2} - \frac{e}{2}} = \dfrac{b-f}{a-e}$ $\quad$ $m_{QR} = \dfrac{\frac{b+d}{2} - \frac{d+f}{2}}{\frac{a+c}{2} - \frac{c+e}{2}} = \dfrac{b+d-d-f}{a+c-c-e} = \dfrac{b-f}{a-e}$ (1)

These have the same gradients so are parallel.

So this is a parallelogram again.