

**SOLUTIONS:**

Change in x, Change in y, Distance, Midpoint

1)	$A(-3, 14)$ and $B(13, -2)$		
	$\begin{aligned}\Delta x &= x_2 - x_1 \\ &= (13) - (-3) \\ &= 13 + 3 \\ &= 16\end{aligned}$ $\begin{aligned}\Delta y &= y_2 - y_1 \\ &= (-2) - (14) \\ &= -2 - 14 \\ &= -16\end{aligned}$	$\begin{aligned}d(A, B) &= \sqrt{(\Delta x)^2 + (\Delta y)^2} \\ &= \sqrt{(16)^2 + (-16)^2} \\ &= \sqrt{256 + 256} \\ &= \sqrt{512} \\ &\approx 22.63\end{aligned}$	$\begin{aligned}(x_m &= \frac{x_1 + x_2}{2}, y_m = \frac{y_1 + y_2}{2}) \\ &= \left(\frac{(-3) + (13)}{2}, \frac{(14) + (-2)}{2}\right) \\ &= \left(\frac{10}{2}, \frac{12}{2}\right) \\ &= (5, 6)\end{aligned}$ <p style="text-align: center;"><i>Midpoint (5, 6)</i></p>
2)	$C(55, -16)$ and $D(67, -11)$		
	$\begin{aligned}\Delta x &= x_2 - x_1 \\ &= (67) - (55) \\ &= 67 - 55 \\ &= 12\end{aligned}$ $\begin{aligned}\Delta y &= y_2 - y_1 \\ &= (-11) - (-16) \\ &= -11 + 16 \\ &= 5\end{aligned}$	$\begin{aligned}d(C, D) &= \sqrt{(\Delta x)^2 + (\Delta y)^2} \\ &= \sqrt{(12)^2 + (5)^2} \\ &= \sqrt{144 + 25} \\ &= \sqrt{169} \\ &= 13\end{aligned}$	$\begin{aligned}(x_m &= \frac{x_1 + x_2}{2}, y_m = \frac{y_1 + y_2}{2}) \\ &= \left(\frac{(-55) + (67)}{2}, \frac{(-16) + (-11)}{2}\right) \\ &= \left(\frac{122}{2}, \frac{-27}{2}\right) \\ &= (61, -13.5)\end{aligned}$ <p style="text-align: center;"><i>Midpoint (61, -13.5)</i></p>
3)	$E(9, 33)$ and $F(-6, 15)$		
	$\begin{aligned}\Delta x &= x_2 - x_1 \\ &= (-6) - (9) \\ &= -6 - 9 \\ &= -15\end{aligned}$ $\begin{aligned}\Delta y &= y_2 - y_1 \\ &= (15) - (33) \\ &= 15 - 33 \\ &= -18\end{aligned}$	$\begin{aligned}d(E, F) &= \sqrt{(\Delta x)^2 + (\Delta y)^2} \\ &= \sqrt{(-15)^2 + (6)^2} \\ &= \sqrt{225 + 324} \\ &= \sqrt{549} \\ &\approx 23.43\end{aligned}$	$\begin{aligned}(x_m &= \frac{x_1 + x_2}{2}, y_m = \frac{y_1 + y_2}{2}) \\ &= \left(\frac{(9) + (-6)}{2}, \frac{(33) + (15)}{2}\right) \\ &= \left(\frac{3}{2}, \frac{48}{2}\right) \\ &= (1.5, 24)\end{aligned}$ <p style="text-align: center;"><i>Midpoint (1.5, 24)</i></p>

4)	<i>G(19, 23) and H(5, 17)</i>		
	$\begin{aligned}\Delta x &= x_2 - x_1 \\ &= (5) - (19) \\ &= 5 - 19 \\ &= -14\end{aligned}$ $\begin{aligned}\Delta y &= y_2 - y_1 \\ &= (17) - (23) \\ &= 17 - 23 \\ &= -6\end{aligned}$	$\begin{aligned}d(G, H) &= \sqrt{(\Delta x)^2 + (\Delta y)^2} \\ &= \sqrt{(-14)^2 + (6)^2} \\ &= \sqrt{196 + 36} \\ &= \sqrt{232} \\ &\approx 15.23\end{aligned}$	$\begin{aligned}(x_m &= \frac{x_1 + x_2}{2}, y_m = \frac{y_1 + y_2}{2}) \\ &= \left(\frac{(19) + (5)}{2}, \frac{(23) + (17)}{2}\right) \\ &= \left(\frac{24}{2}, \frac{40}{2}\right) \\ &= (12, 20)\end{aligned}$ <p style="text-align: center;"><i>Midpoint (12, 20)</i></p>
5)	<i>I(-5, 18) and J(13, -2)</i>		
	$\begin{aligned}\Delta x &= x_2 - x_1 \\ &= (13) - (-5) \\ &= 13 + 5 \\ &= 18\end{aligned}$ $\begin{aligned}\Delta y &= y_2 - y_1 \\ &= (-2) - (18) \\ &= -2 - 18 \\ &= -20\end{aligned}$	$\begin{aligned}d(I, J) &= \sqrt{(\Delta x)^2 + (\Delta y)^2} \\ &= \sqrt{(18)^2 + (-20)^2} \\ &= \sqrt{324 + 400} \\ &= \sqrt{724} \\ &\approx 26.9\end{aligned}$	$\begin{aligned}(x_m &= \frac{x_1 + x_2}{2}, y_m = \frac{y_1 + y_2}{2}) \\ &= \left(\frac{(-5) + (13)}{2}, \frac{(18) + (-2)}{2}\right) \\ &= \left(\frac{8}{2}, \frac{16}{2}\right) \\ &= (4, 8)\end{aligned}$ <p style="text-align: center;"><i>Midpoint (4, 8)</i></p>
6)	<i>K(8, -2) and L(14, 21)</i>		
	$\begin{aligned}\Delta x &= x_2 - x_1 \\ &= (14) - (8) \\ &= 14 - 8 \\ &= 6\end{aligned}$ $\begin{aligned}\Delta y &= y_2 - y_1 \\ &= (21) - (-2) \\ &= 21 + 2 \\ &= 23\end{aligned}$	$\begin{aligned}d(K, L) &= \sqrt{(\Delta x)^2 + (\Delta y)^2} \\ &= \sqrt{(6)^2 + (23)^2} \\ &= \sqrt{36 + 529} \\ &= \sqrt{565} \\ &\approx 23.77\end{aligned}$	$\begin{aligned}(x_m &= \frac{x_1 + x_2}{2}, y_m = \frac{y_1 + y_2}{2}) \\ &= \left(\frac{(8) + (14)}{2}, \frac{(-2) + (21)}{2}\right) \\ &= \left(\frac{22}{2}, \frac{19}{2}\right) \\ &= (11, 9.5)\end{aligned}$ <p style="text-align: center;"><i>Midpoint (11, 9.5)</i></p>

7)	$N(-6, 14)$ and $P(13, -5)$	$\begin{aligned} \Delta x &= x_2 - x_1 \\ &= (13) - (-6) \\ &= 13 + 6 \\ &= 19 \\ \\ \Delta y &= y_2 - y_1 \\ &= (-5) - (14) \\ &= -5 - 14 \\ &= -19 \end{aligned}$	$\begin{aligned} d(N, P) &= \sqrt{(\Delta x)^2 + (\Delta y)^2} \\ &= \sqrt{(-5)^2 + (-14)^2} \\ &= \sqrt{361 + 361} \\ &= \sqrt{722} \\ &\approx 26.87 \end{aligned}$ $\begin{aligned} \left( x_m = \frac{x_1 + x_2}{2}, y_m = \frac{y_1 + y_2}{2} \right) \\ \left( \frac{(-6) + (13)}{2}, \frac{(14) + (-5)}{2} \right) \\ \left( \frac{7}{2}, \frac{9}{2} \right) \\ (3.5, 4.5) \end{aligned}$ <p style="text-align: center;"><i>Midpoint</i> (3.5, 4.5)</p>
8)	$Q(83, -19)$ and $R(44, -73)$	$\begin{aligned} \Delta x &= x_2 - x_1 \\ &= (44) - (83) \\ &= 44 - 83 \\ &= -39 \\ \\ \Delta y &= y_2 - y_1 \\ &= (-73) - (-19) \\ &= -73 + 19 \\ &= -54 \end{aligned}$	$\begin{aligned} d(Q, R) &= \sqrt{(\Delta x)^2 + (\Delta y)^2} \\ &= \sqrt{(-39)^2 + (54)^2} \\ &= \sqrt{1521 + 2916} \\ &= \sqrt{4437} \\ &\approx 66.61 \end{aligned}$ $\begin{aligned} \left( x_m = \frac{x_1 + x_2}{2}, y_m = \frac{y_1 + y_2}{2} \right) \\ \left( \frac{(83) + (44)}{2}, \frac{(-19) + (-73)}{2} \right) \\ \left( \frac{127}{2}, \frac{-92}{2} \right) \\ (63.5, -46) \end{aligned}$ <p style="text-align: center;"><i>Midpoint</i> (63.5, 46)</p>
9)	$S(12, 57)$ and $T(0, 52)$	$\begin{aligned} \Delta x &= x_2 - x_1 \\ &= (0) - (12) \\ &= 0 - 12 \\ &= -12 \\ \\ \Delta y &= y_2 - y_1 \\ &= (52) - (57) \\ &= 52 - 57 \\ &= -5 \end{aligned}$	$\begin{aligned} d(S, T) &= \sqrt{(\Delta x)^2 + (\Delta y)^2} \\ &= \sqrt{(-12)^2 + (0)^2} \\ &= \sqrt{144 + 0} \\ &= \sqrt{144} \\ &= 12 \end{aligned}$ $\begin{aligned} \left( x_m = \frac{x_1 + x_2}{2}, y_m = \frac{y_1 + y_2}{2} \right) \\ \left( \frac{(12) + (0)}{2}, \frac{(57) + (52)}{2} \right) \\ \left( \frac{12}{2}, \frac{109}{2} \right) \\ (6, 54.5) \end{aligned}$ <p style="text-align: center;"><i>Midpoint</i> (6, 54.5)</p>

10)	<i>U(0, -12) and V(-27, 0)</i>		
	$\begin{aligned}\Delta x &= x_2 - x_1 \\ &= (-27) - (0) \\ &= -27 - 0 \\ &= -27\end{aligned}$ $\begin{aligned}\Delta y &= y_2 - y_1 \\ &= (0) - (-12) \\ &= 0 + 12 \\ &= 12\end{aligned}$	$\begin{aligned}d(U, V) &= \sqrt{(\Delta x)^2 + (\Delta y)^2} \\ &= \sqrt{(-27)^2 + (12)^2} \\ &= \sqrt{729 + 144} \\ &= \sqrt{873} \\ &\approx 29.55\end{aligned}$	$\left(x_m = \frac{x_1 + x_2}{2}, y_m = \frac{y_1 + y_2}{2}\right)$ $\left(\frac{(0) + (-27)}{2}, \frac{(-12) + (0)}{2}\right)$ $\left(\frac{-27}{2}, \frac{-12}{2}\right)$ $(-13.5, -6)$ <p style="text-align: center;"><i>Midpoint</i> (-13.5, -6)</p>
11)	<i>W(-45, 147) and Z(99, -3)</i>		
	$\begin{aligned}\Delta x &= x_2 - x_1 \\ &= (99) - (-45) \\ &= 99 + 45 \\ &= 144\end{aligned}$ $\begin{aligned}\Delta y &= y_2 - y_1 \\ &= (-3) - (147) \\ &= -3 - 147 \\ &= -150\end{aligned}$	$\begin{aligned}d(W, Z) &= \sqrt{(\Delta x)^2 + (\Delta y)^2} \\ &= \sqrt{(144)^2 + (150)^2} \\ &= \sqrt{20736 + 22500} \\ &= \sqrt{43236} \\ &\approx 207.93\end{aligned}$	$\left(x_m = \frac{x_1 + x_2}{2}, y_m = \frac{y_1 + y_2}{2}\right)$ $\left(\frac{(-45) + (99)}{2}, \frac{(147) + (-3)}{2}\right)$ $\left(\frac{54}{2}, \frac{144}{2}\right)$ $(27, 72)$ <p style="text-align: center;"><i>Midpoint</i> (27, 72)</p>