1. Let $A = (4, 5)$ and $B = (6, 1)$.
   (a) If $T = (0, 2)$, find a point U for which $\overleftrightarrow{AB}$ is parallel to $\overleftrightarrow{TU}$.
   (b) If $T = (0, 2)$, find a point V for which $\overleftrightarrow{AB}$ is perpendicular to $\overleftrightarrow{TV}$
   (c) Find a different answer to the previous problem about point V.
2. Let $J = (-5, 2)$ and $K = (4, -3)$.
   (a) Find a point L for which $\overleftrightarrow{JL} \perp \overleftrightarrow{JK}$ and $JK = JL$.
   (b) Find a point N for which $\overleftrightarrow{JN} \perp \overleftrightarrow{JK}$ and $JN = 2JK$.
3. Let $P = (-5, 2)$ and $Q = (1, -1)$.
   (a) Find a point R so that $\triangle PQR$ is an isosceles triangle.
   (b) Find a point S so that $\triangle PQS$ is a right triangle.
   (c) Find a point T so that $\triangle PQT$ is an isosceles right triangle.
4. Consider the points $A = (-3, 2)$ and $B = (4, 1)$.
   (a) If $X = (1, 6)$, find a point Y so that $ABXY$ (or $ABYX$) is a parallelogram.
   (b) Find another answer to the question above.
   (c) Find two points C and D so that $ABCD$ is a square.
   (d) Find two other points that answer the question above.
   (e) Find two points Z and W so that $ABZW$ (or $ABWZ$) is a non-square rhombus.
5. **Challenge** - $H = (-2, -4), I = (-2, 6)$, and $J = (3, -1)$ are three vertices of an isosceles trapezoid $HIJK$ having $\overline{HI}$ as one of its bases. Find the coordinates of the fourth vertex K.

1. (a) There are infinitely many correct answers because the length TU does not matter. Three options "close to" T are $U = (-2, 6)$, $U = (2, -2)$, and $U = (4, -6)$.
   (b) Again, there are infinitely many correct answers. If we reduce the perpendicular slope to lowest terms (1/2) we get an even tighter list: $V = (2, 3)$ or $(4, 4)$ or $(-2, 1)$ or $(-4, 0)$ to name a few.
   (c) See above.

2. (a) The slope of $\overleftrightarrow{JK}$ is $-5/9$, so that of $\overleftrightarrow{JL}$ must be the negative reciprocal, 9/5. To get the distances $JK = JL$, count this slope out just once, as you did in finding the "walk" from J to K in the first place. $L = (0, 11)$ and $L = (-10, -7)$ are the only correct answers.
   (b) $N = (5, 20)$ and $N = (-15, -16)$ are the only correct answers.

3. (a) The slope of $\overleftrightarrow{PQ}$ is $-3/6$, so to create an identical distance, simply count out 6 by 3 in any reasonable direction from either of P or Q. Possible answers include the third vertex R at $(-2, 8)$, $(1, 5)$ or $(-8, -4)$ just to list some of those reachable from P.
   (b) Now we're restricted to counting out a "perpendicular slope" only. The only possibilities are $S = (-2, 8)$, $(-8, -4)$, $(4, 5)$, or $(-2, -7)$.
   (c) My choices above satisfy this problem also.

4. (a) Options are $Y = (-6, 7)$, $(8, 5)$, or $(0, -3)$.
   (b) See above.
   (c) C and D can either be $(-2, 9)$ and $(5, 8)$ or else $(-4, -5)$ and $(3, -6)$.
   (d) See above.
   (e) The slope of $\overleftrightarrow{AB}$ is $-1/7$, so the tactic is to count out a slope also using 1 and 7 in such a way as not to create collinear points. Z and W at $(-10, 1)$ and $(-3, 0)$ is one possibility.

5. $\overline{HJ}$ is one of the "off" sides, with a slope of 3/5. The "count" from I to K to create the matching side must also involve 3 and 5. Trial and error with the shape requires $K = (3, 3)$.