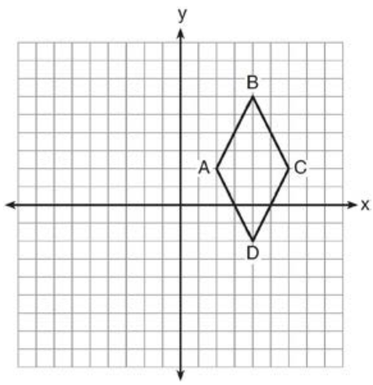
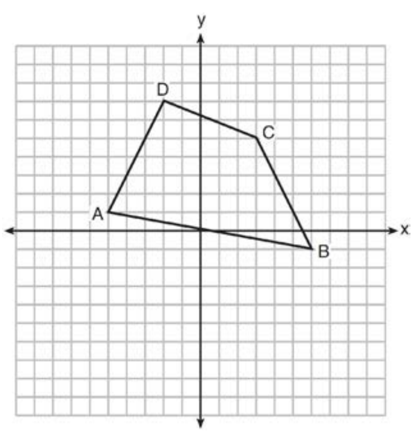
G.GPE.B.4: Quadrilaterals in the Coordinate Plane 2

1 Quadrilateral $ABCD$ is graphed on the set of axes below.



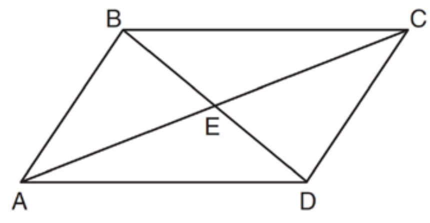
Which quadrilateral best classifies $ABCD$?
1) trapezoid
2) rectangle
3) rhombus
4) square

2 In the diagram below, quadrilateral $ABCD$ has vertices $A(-5,1)$, $B(6,-1)$, $C(3,5)$, and $D(-2,7)$.



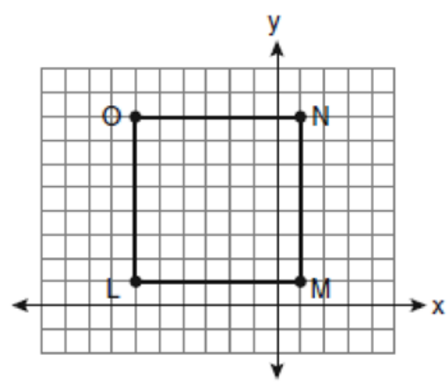
What are the coordinates of the midpoint of diagonal $\overline{AC}$?
1) $(-1,3)$
2) $(1,3)$
3) $(1,4)$
4) $(2,3)$

3 In the diagram below, parallelogram $ABCD$ has vertices $A(1,3)$, $B(5,7)$, $C(10,7)$, and $D(6,3)$. Diagonals $\overline{AC}$ and $\overline{BD}$ intersect at E.



What are the coordinates of point E?
1) $(0.5,2)$
2) $(4.5,2)$
3) $(5.5,5)$
4) $(7.5,7)$

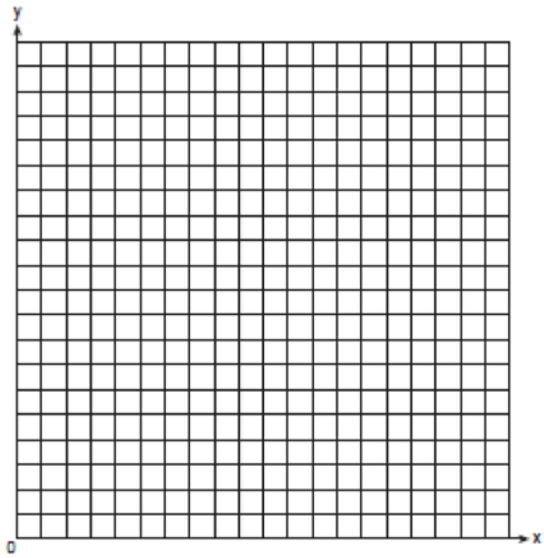
4 Square $LMNO$ is shown in the diagram below.



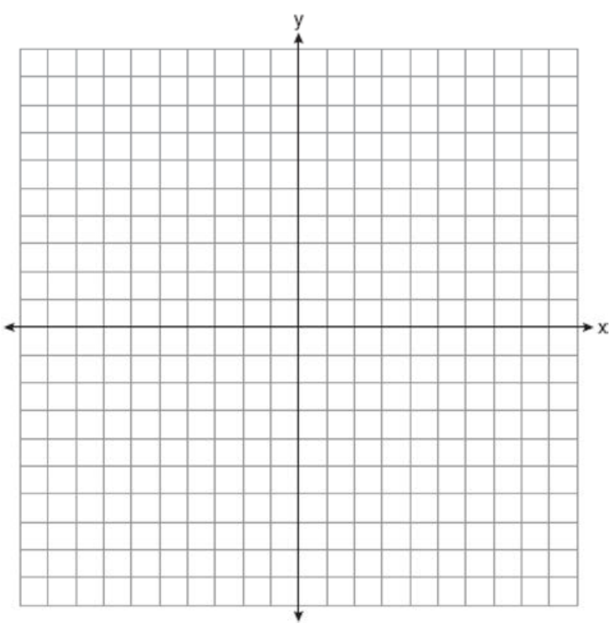
What are the coordinates of the midpoint of diagonal $\overline{LN}$?
1) $\left(4\frac{1}{2},-2\frac{1}{2}\right)$
2) $\left(-3\frac{1}{2},3\frac{1}{2}\right)$
3) $\left(-2\frac{1}{2},3\frac{1}{2}\right)$
4) $\left(-2\frac{1}{2},4\frac{1}{2}\right)$

Name: ________________________

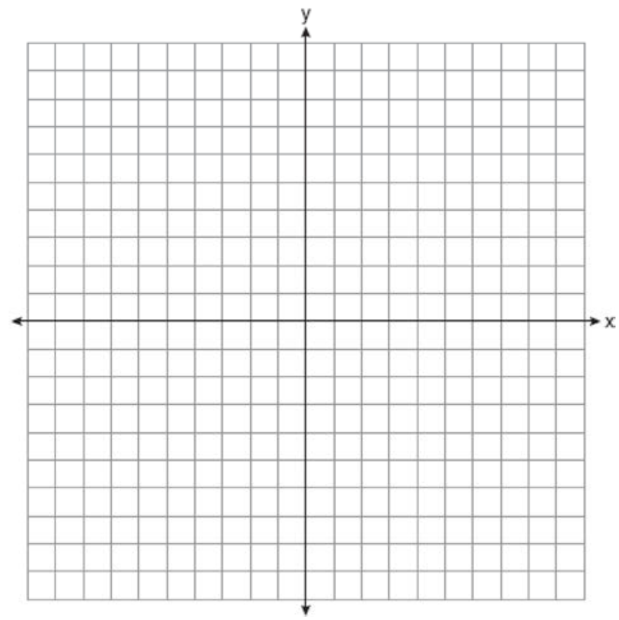
5 Ashanti is surveying for a new parking lot shaped like a parallelogram. She knows that three of the vertices of parallelogram *ABCD* are $A(0,0)$, $B(5,2)$, and $C(6,5)$. Find the coordinates of point *D* and sketch parallelogram *ABCD* on the accompanying set of axes. Justify mathematically that the figure you have drawn is a parallelogram.



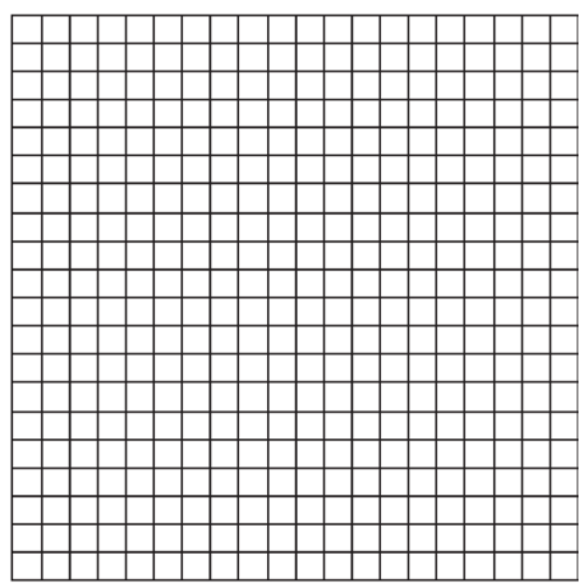
6 In square *GEOM*, the coordinates of *G* are $(2,-2)$ and the coordinates of *O* are $(-4,2)$. Determine and state the coordinates of vertices *E* and *M*. [The use of the set of axes below is optional.]



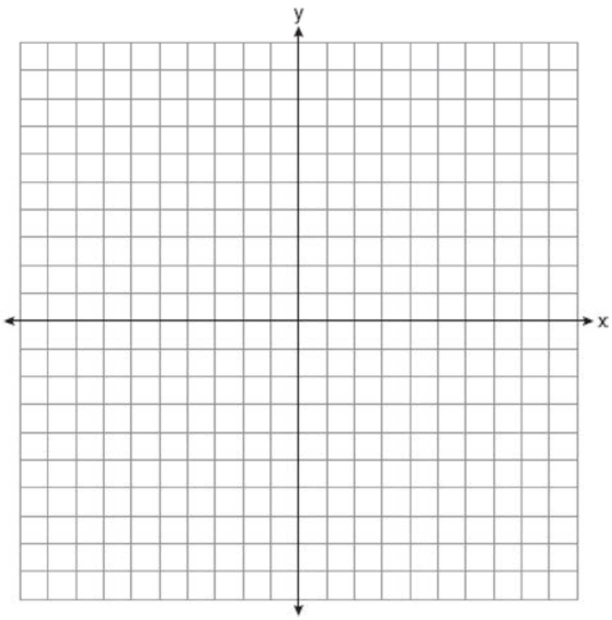
7 Quadrilateral *NATS* has coordinates $N(-4,-3)$, $A(1,2)$, $T(8,1)$, and $S(3,-4)$. Prove quadrilateral *NATS* is a rhombus. [The use of the set of axes below is optional.]



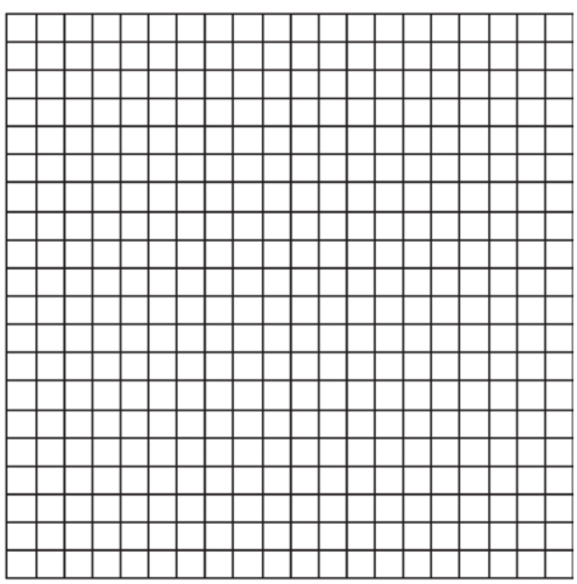
8 The coordinates of quadrilateral *ABCD* are $A(-1,-5)$, $B(8,2)$, $C(11,13)$, and $D(2,6)$. Using coordinate geometry, prove that quadrilateral *ABCD* is a rhombus. [The use of the grid is optional.]



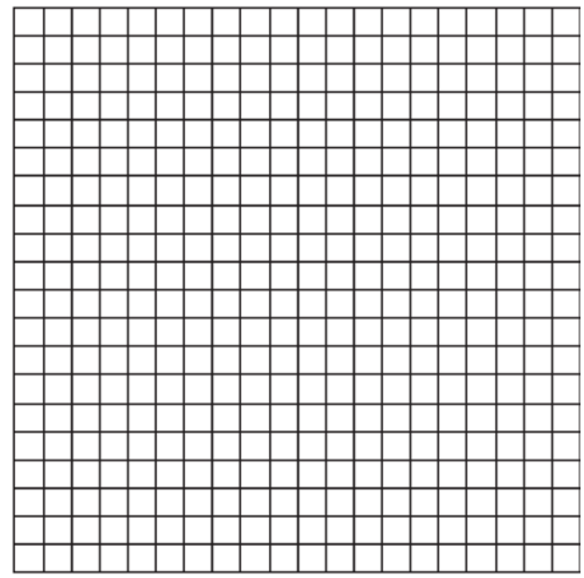
9 The vertices of quadrilateral *MATH* have coordinates $M(-4,2)$, $A(-1,-3)$, $T(9,3)$, and $H(6,8)$. Prove that quadrilateral *MATH* is a parallelogram. Prove that quadrilateral *MATH* is a rectangle. [The use of the set of axes below is optional.]



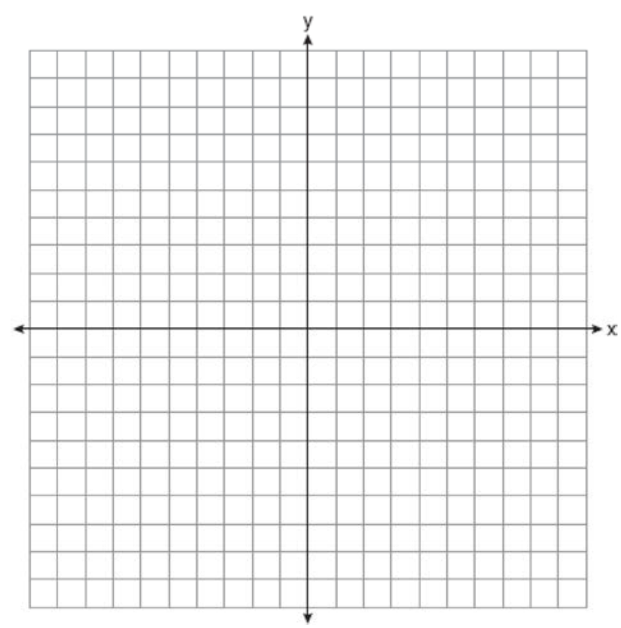
10 Given: $A(-2,2)$, $B(6,5)$, $C(4,0)$, $D(-4,-3)$
Prove: *ABCD* is a parallelogram but not a rectangle. [The use of the grid is optional.]



11 Jim is experimenting with a new drawing program on his computer. He created quadrilateral *TEAM* with coordinates $T(-2,3)$, $E(-5,-4)$, $A(2,-1)$, and $M(5,6)$. Jim believes that he has created a rhombus but not a square. Prove that Jim is correct. [The use of the grid is optional.]

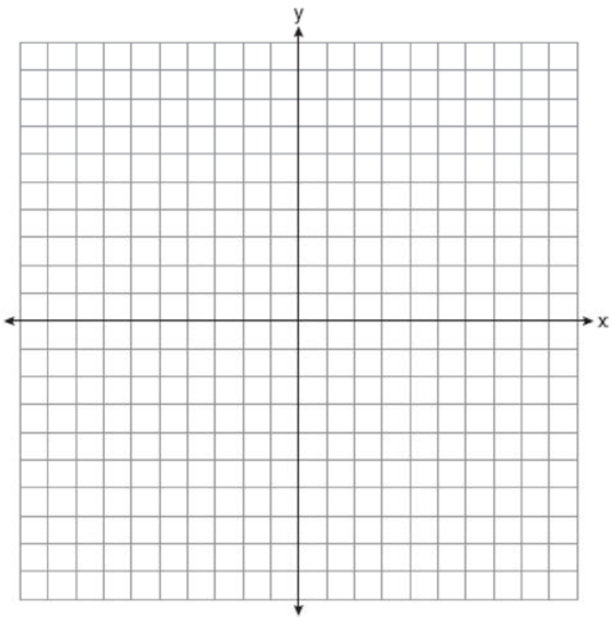


12 Quadrilateral *PQRS* has vertices $P(-2,3)$, $Q(3,8)$, $R(4,1)$, and $S(-1,-4)$. Prove that *PQRS* is a rhombus. Prove that *PQRS* is *not* a square. [The use of the set of axes below is optional.]

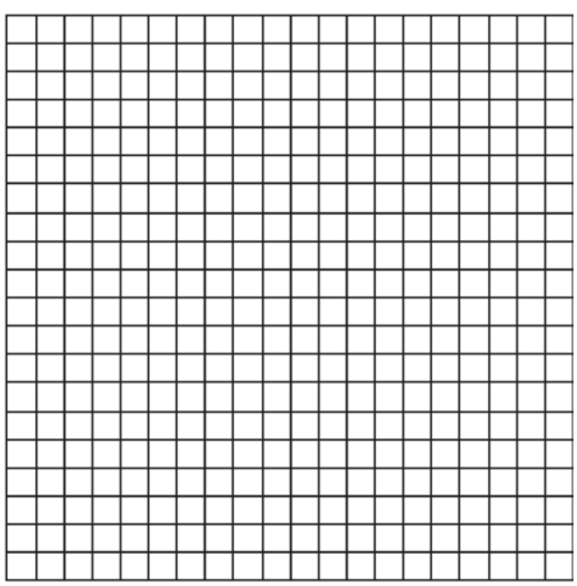


Name: ________________________

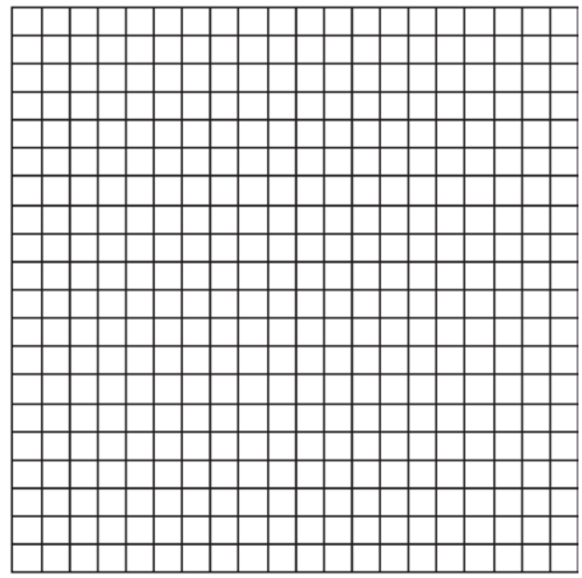
13 The vertices of quadrilateral $JKLM$ have coordinates $J(-3,1)$, $K(1,-5)$, $L(7,-2)$, and $M(3,4)$. Prove that $JKLM$ is a parallelogram. Prove that $JKLM$ is *not* a rhombus. [The use of the set of axes below is optional.]



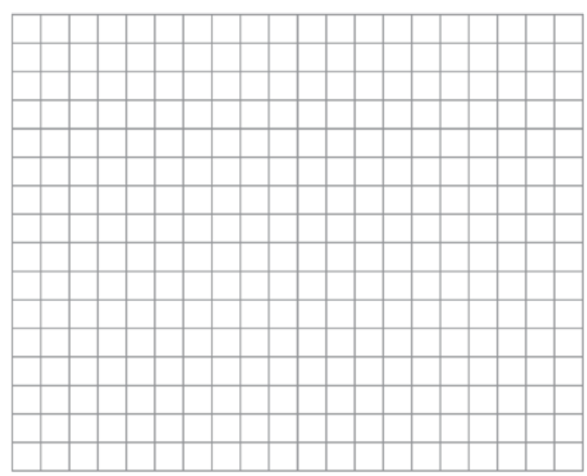
14 Quadrilateral $ABCD$ has vertices $A(2,3)$, $B(7,10)$, $C(9,4)$, and $D(4,-3)$. Prove that $ABCD$ is a parallelogram but *not* a rhombus. [The use of the grid is optional.]



15 Quadrilateral $MATH$ has coordinates $M(1,1)$, $A(-2,5)$, $T(3,5)$, and $H(6,1)$. Prove that quadrilateral $MATH$ is a rhombus and prove that it is *not* a square. [The use of the grid is optional.]



16 Given: Quadrilateral $ABCD$ has vertices $A(-5,6)$, $B(6,6)$, $C(8,-3)$, and $D(-3,-3)$.
Prove: Quadrilateral $ABCD$ is a parallelogram but is neither a rhombus nor a rectangle. [The use of the grid below is optional.]



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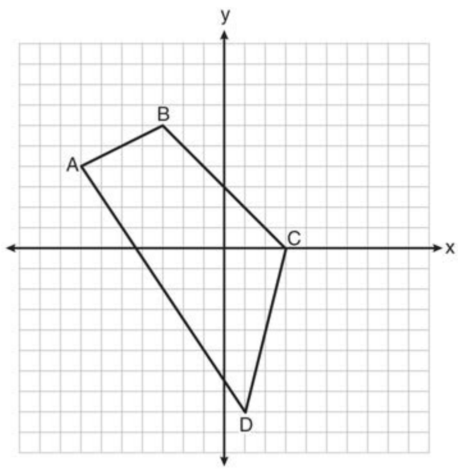
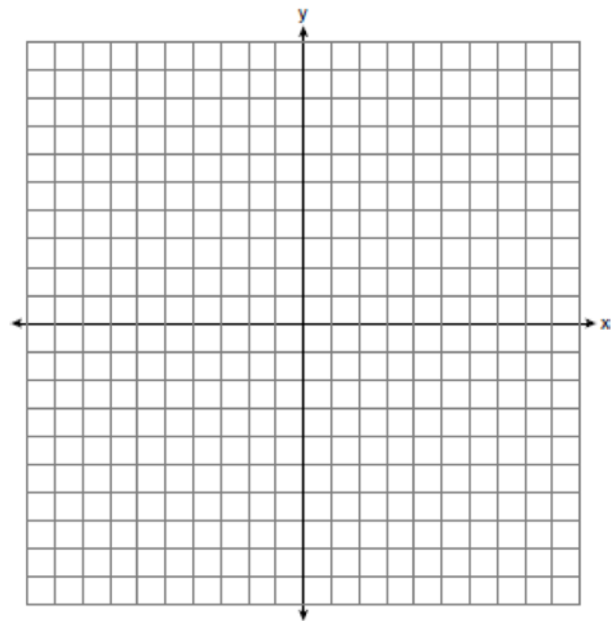
17 Quadrilateral $ABCD$ with vertices $A(-7,4)$, $B(-3,6)$, $C(3,0)$, and $D(1,-8)$ is graphed on the set of axes below. Quadrilateral $MNPQ$ is formed by joining M, N, P, and Q, the midpoints of $\overline{AB}$, $\overline{BC}$, $\overline{CD}$, and $\overline{AD}$, respectively. Prove that quadrilateral $MNPQ$ is a parallelogram. Prove that quadrilateral $MNPQ$ is *not* a rhombus.



18 In rhombus $MATH$, the coordinates of the endpoints of the diagonal $\overline{MT}$ are $M(0,-1)$ and $T(4,6)$. Write an equation of the line that contains diagonal $\overline{AH}$. [Use of the set of axes below is optional.] Using the given information, explain how you know that your line contains diagonal $\overline{AH}$.



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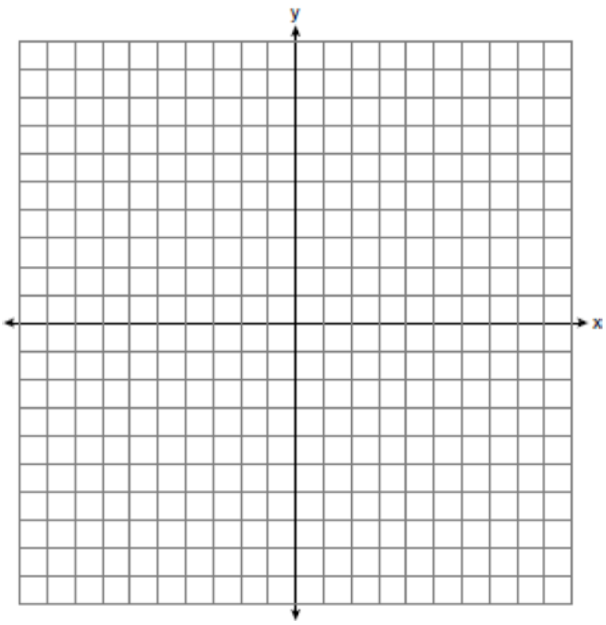
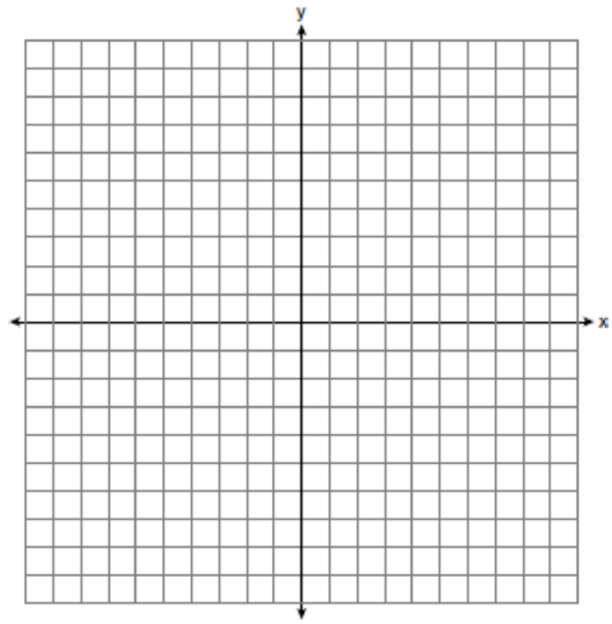
19 In the coordinate plane, the vertices of triangle PAT are $P(-1,-6)$, $A(-4,5)$, and $T(5,-2)$. Prove that $\triangle PAT$ is an isosceles triangle. State the coordinates of R so that quadrilateral $PART$ is a parallelogram. Prove that quadrilateral $PART$ is a parallelogram. [The use of the set of axes below is optional.]

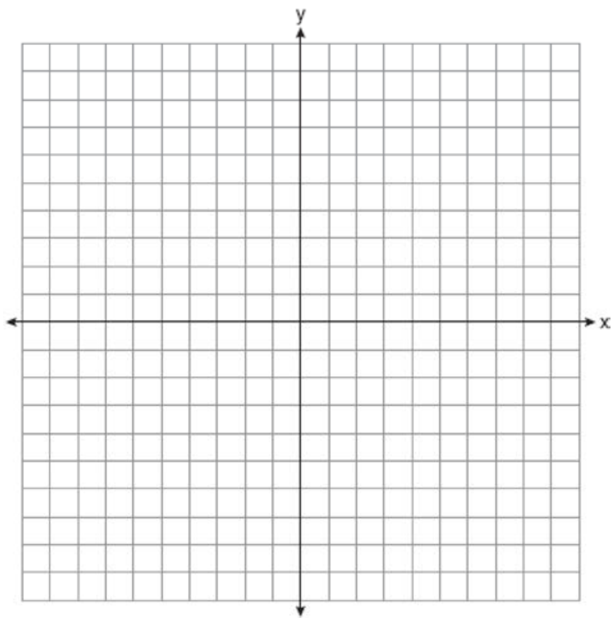


20 In the coordinate plane, the vertices of $\triangle RST$ are $R(6,-1)$, $S(1,-4)$, and $T(-5,6)$. Prove that $\triangle RST$ is a right triangle. State the coordinates of point P such that quadrilateral $RSTP$ is a rectangle. Prove that your quadrilateral $RSTP$ is a rectangle. [The use of the set of axes below is optional.]

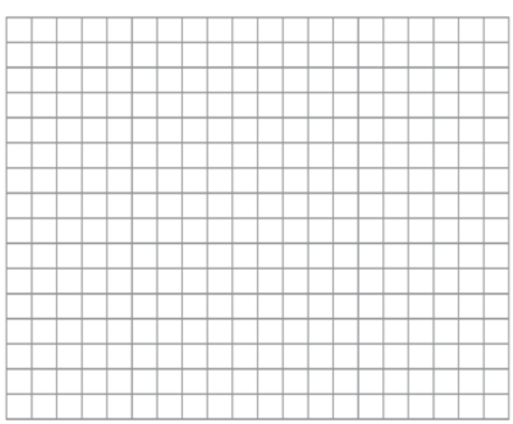


Name: ________________________

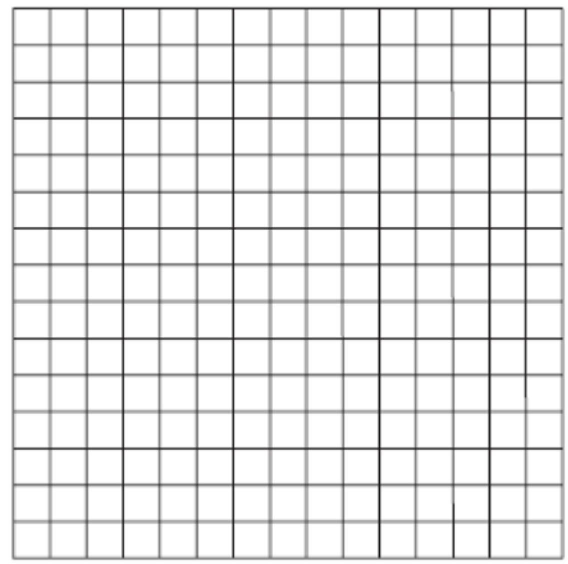
21 The coordinates of the vertices of $\triangle ABC$ are $A(1,2)$, $B(-5,3)$, and $C(-6,-3)$. Prove that $\triangle ABC$ is isosceles. State the coordinates of point D such that quadrilateral $ABCD$ is a square. Prove that your quadrilateral $ABCD$ is a square. [The use of the set of axes below is optional.]



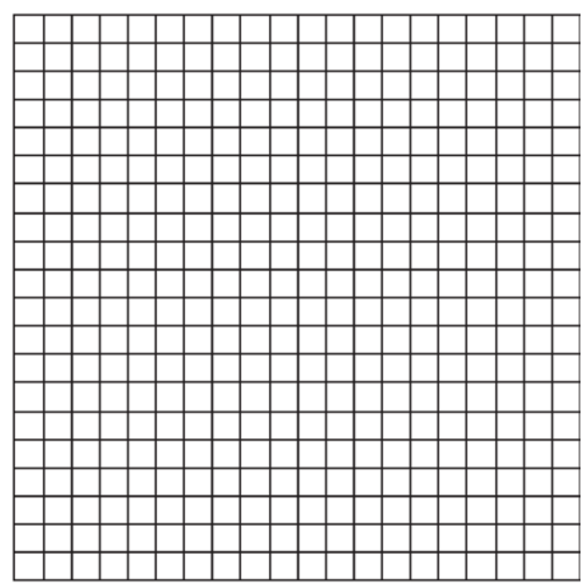
22 Given: $\triangle ABC$ with vertices $A(-6,-2)$, $B(2,8)$, and $C(6,-2)$. $\overline{AB}$ has midpoint D, $\overline{BC}$ has midpoint E, and $\overline{AC}$ has midpoint F.
Prove: $ADEF$ is a parallelogram
$ADEF$ is *not* a rhombus
[The use of the grid is optional.]



23 Given: $A(1,6)$, $B(7,9)$, $C(13,6)$, and $D(3,1)$
Prove: $ABCD$ is a trapezoid. [*The use of the accompanying grid is optional*.]

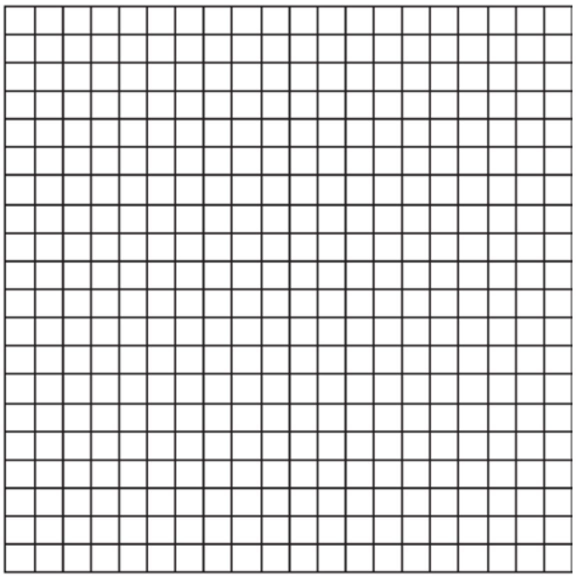


24 Quadrilateral $KATE$ has vertices $K(1,5)$, $A(4,7)$, $T(7,3)$, and $E(1,-1)$.
a Prove that $KATE$ is a trapezoid. [The use of the grid is optional.]
b Prove that $KATE$ is *not* an isosceles trapezoid.

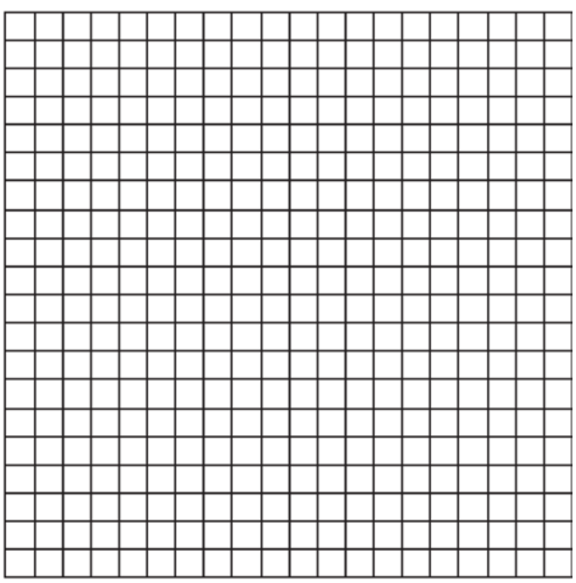


Name: ________________________

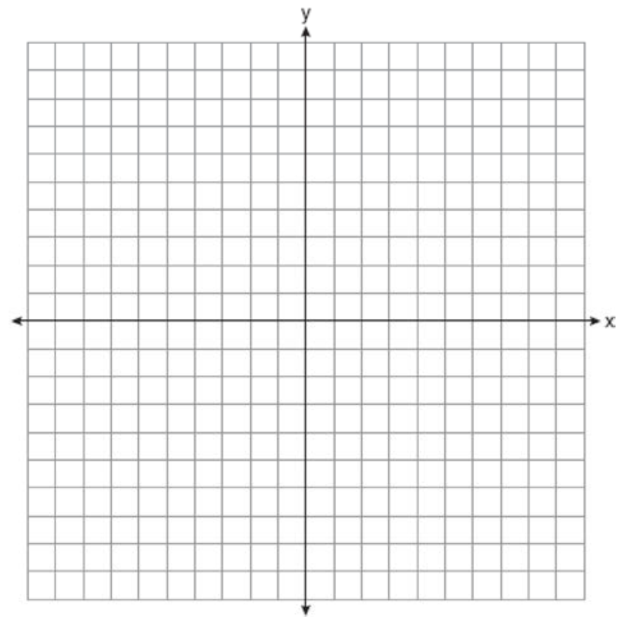
25 The coordinates of quadrilateral $JKLM$ are $J(1,-2)$, $K(13,4)$, $L(6,8)$, and $M(-2,4)$. Prove that quadrilateral $JKLM$ is a trapezoid but *not* an isosceles trapezoid. [The use of the grid is optional.]



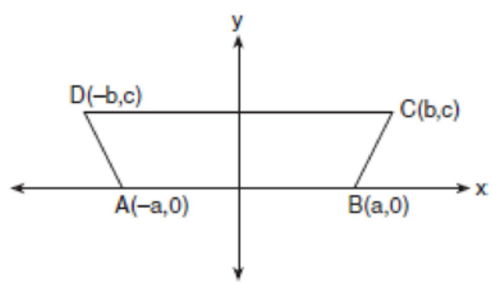
26 Given: $T(-1,1)$, $R(3,4)$, $A(7,2)$, and $P(-1,-4)$
Prove: $TRAP$ is a trapezoid.
$TRAP$ is not an isosceles trapezoid.
[The use of the grid is optional.]



27 Riley plotted $A(-1,6)$, $B(3,8)$, $C(6,-1)$, and $D(1,0)$ to form a quadrilateral. Prove that Riley's quadrilateral $ABCD$ is a trapezoid. [The use of the set of axes on the next page is optional.] Riley defines an isosceles trapezoid as a trapezoid with congruent diagonals. Use Riley's definition to prove that $ABCD$ is *not* an isosceles trapezoid.



28 In the accompanying diagram of $ABCD$, where $a \neq b$, prove $ABCD$ is an isosceles trapezoid.



G.GPE.B.4: Quadrilaterals in the Coordinate Plane 2
Answer Section

1 ANS: 3
Both pairs of opposite sides are parallel, so not a trapezoid. None of the angles are right angles, so not a rectangle or square. All sides are congruent, so a rhombus.

REF: 081411ge

2 ANS: 1

$M_x = \frac{-5+3}{2} = \frac{-2}{2} = -1.\ M_y = \frac{1+5}{2} = \frac{6}{2} = 3.$

REF: 061402ge

3 ANS: 3

$M_x = \frac{1+10}{2} = \frac{11}{2} = 5.5\ M_y = \frac{3+7}{2} = \frac{10}{2} = 5.$

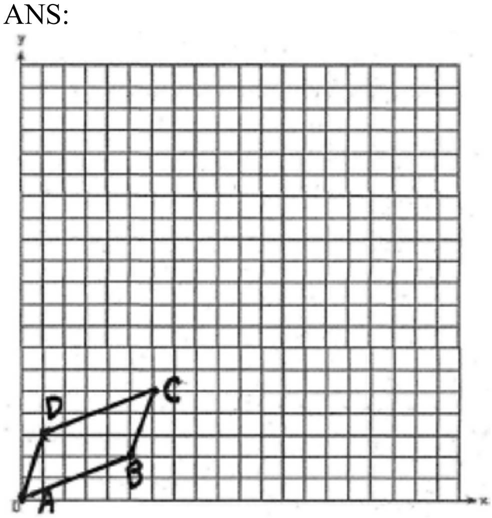
REF: 081407ge

4 ANS: 4

$M_x = \frac{-6+1}{2} = -\frac{5}{2}.\ M_y = \frac{1+8}{2} = \frac{9}{2}.$

REF: 060919ge

5 ANS:

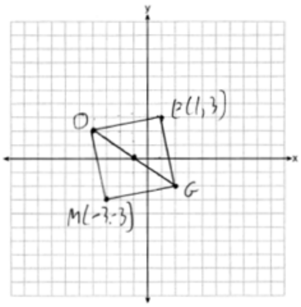


Both pairs of opposite sides of a parallelogram are parallel. Parallel lines have the same slope. The slope of side $\overline{BC}$ is 3. For side $\overline{AD}$ to have a slope of 3, the coordinates of point D must be (1,3). $m\overline{AB} = \frac{2-0}{5-0} = \frac{2}{5}$ $m\overline{AD} = \frac{3-0}{1-0} = 3$

$m\overline{CD} = \frac{5-3}{6-1} = \frac{2}{5}$ $m\overline{BC} = \frac{5-2}{6-5} = 3$

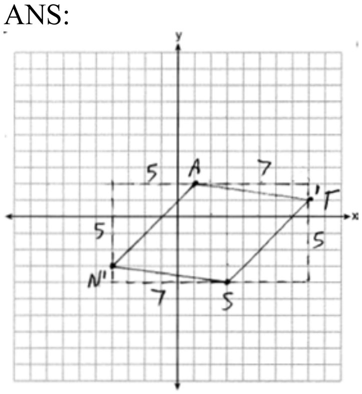
REF: 080032a

6 ANS:



REF: 011731geo

7 ANS:



$\overline{AN} \cong \overline{AT} \cong \overline{TS} \cong \overline{SN}$

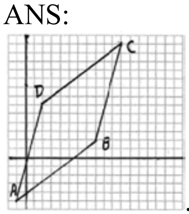
$$\sqrt{5^2+5^2} = \sqrt{7^2+1^2} = \sqrt{5^2+5^2} = \sqrt{7^2+1^2}$$

$$\sqrt{50} = \sqrt{50} = \sqrt{50} = \sqrt{50}$$

Quadrilateral *NATS* is a rhombus because all four sides are congruent.

REF: 012032geo

8 ANS:



. To prove that *ABCD* is a rhombus, show that all sides are congruent using the distance formula:

$$d_{\overline{AB}} = \sqrt{(8-(-1))^2+(2-(-5))^2} = \sqrt{130}.$$

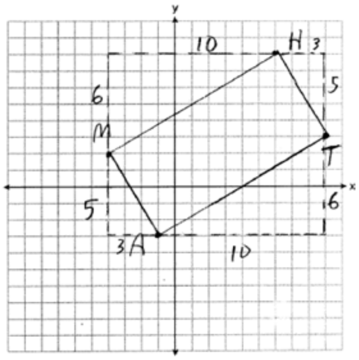
$$d_{\overline{BC}} = \sqrt{(11-8)^2+(13-2)^2} = \sqrt{130}$$

$$d_{\overline{CD}} = \sqrt{(11-2)^2+(13-6)^2} = \sqrt{130}$$

$$d_{\overline{AD}} = \sqrt{(2-(-1))^2+(6-(-5))^2} = \sqrt{130}$$

REF: 060327b

9 ANS:



$m_{\overline{MH}} = \frac{6}{10} = \frac{3}{5}$, $m_{\overline{AT}} = \frac{6}{10} = \frac{3}{5}$, $m_{\overline{MA}} = -\frac{5}{3}$, $m_{\overline{HT}} = -\frac{5}{3}$; $\overline{MH} \parallel \overline{AT}$ and $\overline{MA} \parallel \overline{HT}$.

MATH is a parallelogram since both sides of opposite sides are parallel. $m_{\overline{MA}} = -\frac{5}{3}$, $m_{\overline{AT}} = \frac{3}{5}$. Since the slopes are negative reciprocals, $\overline{MA} \perp \overline{AT}$ and $\angle A$ is a right angle. *MATH* is a rectangle because it is a parallelogram with a right angle.

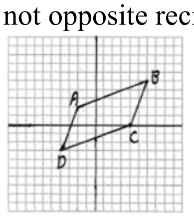
REF: 081835geo

10 ANS:

To prove that *ABCD* is a parallelogram, show that both pairs of opposite sides of the parallelogram are parallel by showing the opposite sides have the same slope: $m_{\overline{AB}} = \frac{5-2}{6-(-2)} = \frac{3}{8}$ $m_{\overline{AD}} = \frac{-3-2}{-4-(-2)} = \frac{5}{2}$

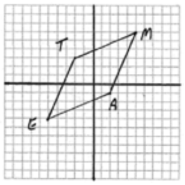
$$m_{\overline{CD}} = \frac{-3-0}{-4-4} = \frac{3}{8} \quad m_{\overline{BC}} = \frac{5-0}{6-4} = \frac{5}{2}$$

A rectangle has four right angles. If *ABCD* is a rectangle, then $\overline{AB} \perp \overline{BC}$, $\overline{BC} \perp \overline{CD}$, $\overline{CD} \perp \overline{AD}$, and $\overline{AD} \perp \overline{AB}$. Lines that are perpendicular have slopes that are the opposite and reciprocal of each other. Because $\frac{3}{8}$ and $\frac{5}{2}$ are not opposite reciprocals, the consecutive sides of *ABCD* are not perpendicular, and *ABCD* is not a rectangle.



REF: 060633b

11 ANS:



. To prove that *TEAM* is a rhombus, show that all sides are congruent using the distance formula: $d_{\overline{ET}} = \sqrt{(-2-(-5))^2 + (3-(-4))^2} = \sqrt{58}$. A square has four right angles. If *TEAM* is a square, then $\overline{ET} \perp \overline{AE}$,

$d_{\overline{AM}} = \sqrt{(2-5)^2 + ((-1)-6)^2} = \sqrt{58}$

$d_{\overline{AE}} = \sqrt{(-5-2)^2 + (-4-(-1))^2} = \sqrt{58}$

$d_{\overline{MT}} = \sqrt{(-2-5)^2 + (3-6)^2} = \sqrt{58}$

$\overline{AE} \perp \overline{AM}$, $\overline{AM} \perp \overline{AT}$ and $\overline{MT} \perp \overline{ET}$. Lines that are perpendicular have slopes that are opposite reciprocals of each other. The slopes of sides of *TEAM* are: $m_{\overline{ET}} = \dfrac{-4-3}{-5-(-2)} = \dfrac{7}{3}$ $m_{\overline{AE}} = \dfrac{-4-(-1)}{-5-2} = \dfrac{3}{7}$ Because $\dfrac{7}{3}$ and $\dfrac{3}{7}$ are not

$$m_{\overline{AM}} = \frac{6-(-1)}{5-2} = \frac{7}{3} \quad m_{\overline{MT}} = \frac{3-6}{-2-5} = \frac{3}{7}$$

opposite reciprocals, consecutive sides of *TEAM* are not perpendicular, and *TEAM* is not a square.

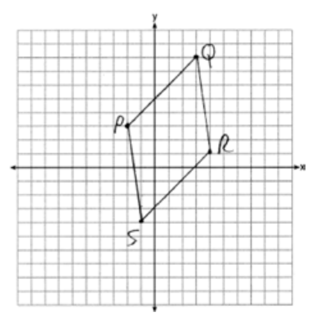
REF: 010533b

12 ANS:

$\overline{PQ}$ $\sqrt{(8-3)^2 + (3--2)^2} = \sqrt{50}$ $\overline{QR}$ $\sqrt{(1-8)^2 + (4-3)^2} = \sqrt{50}$ $\overline{RS}$ $\sqrt{(-4-1)^2 + (-1-4)^2} = \sqrt{50}$

$\overline{PS}$ $\sqrt{(-4-3)^2 + (-1--2)^2} = \sqrt{50}$ *PQRS* is a rhombus because all sides are congruent. $m_{\overline{PQ}} = \dfrac{8-3}{3--2} = \dfrac{5}{5} = 1$

$m_{\overline{QR}} = \dfrac{1-8}{4-3} = -7$ Because the slopes of adjacent sides are not opposite reciprocals, they are not perpendicular and do not form a right angle. Therefore *PQRS* is not a square.



REF: 061735geo

13 ANS:

$m_{\overline{JM}} = \dfrac{1-4}{-3-3} = \dfrac{-3}{-6} = \dfrac{1}{2}$ Since both opposite sides have equal slopes and are parallel, *JKLM* is a parallelogram.

$m_{=\overline{ML}} = \dfrac{4--2}{3-7} = \dfrac{6}{-4} = -\dfrac{3}{2}$

$m_{\overline{LK}} = \dfrac{-2--5}{7-1} = \dfrac{3}{6} = \dfrac{1}{2}$

$m_{\overline{KJ}} = \dfrac{-5-1}{1--3} = \dfrac{-6}{4} = -\dfrac{3}{2}$

$\overline{JM} = \sqrt{(-3-3)^2+(1-4)^2} = \sqrt{45}$. $\overline{JM}$ is not congruent to $\overline{ML}$, so *JKLM* is not a rhombus since not all sides

$\overline{ML} = \sqrt{(7-3)^2+(-2-4)^2} = \sqrt{52}$

are congruent.

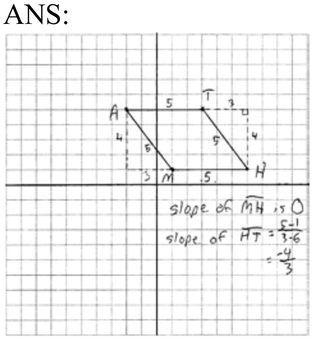
REF: 061438ge

14 ANS:

$m_{\overline{AB}} = \dfrac{10-3}{7-2} = \dfrac{7}{5}$, $m_{\overline{CD}} = \dfrac{4-(-3)}{9-4} = \dfrac{7}{5}$, $m_{\overline{AD}} = \dfrac{3-(-3)}{2-4} = \dfrac{6}{-2} = -3$, $m_{\overline{BC}} = \dfrac{10-4}{7-9} = \dfrac{6}{-2} = -3$ (Definition of slope). $\overline{AB} \parallel \overline{CD}$, $\overline{AD} \parallel \overline{BC}$ (Parallel lines have equal slope). Quadrilateral *ABCD* is a parallelogram (Definition of parallelogram). $d_{\overline{AD}} = \sqrt{(2-4)^2+(3-(-3))^2} = \sqrt{40}$, $d_{\overline{AB}} = \sqrt{(7-2)^2+(10-3)^2} = \sqrt{74}$ (Definition of distance). $\overline{AD}$ is not congruent to $\overline{AB}$ (Congruent lines have equal distance). *ABCD* is not a rhombus (A rhombus has four equal sides).

REF: 061031b

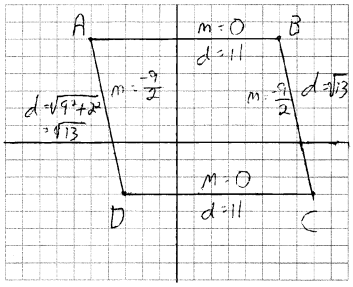
15 ANS:



The length of each side of quadrilateral is 5. Since each side is congruent, quadrilateral *MATH* is a rhombus. The slope of $\overline{MH}$ is 0 and the slope of $\overline{HT}$ is $-\dfrac{4}{3}$. Since the slopes are not negative reciprocals, the sides are not perpendicular and do not form rights angles. Since adjacent sides are not perpendicular, quadrilateral *MATH* is not a square.

REF: 011138ge

16 ANS:



$\overline{AB} \parallel \overline{CD}$ and $\overline{AD} \parallel \overline{CB}$ because their slopes are equal. $ABCD$ is a parallelogram because opposite side are parallel. $\overline{AB} \neq \overline{BC}$. $ABCD$ is not a rhombus because all sides are not equal. $\overline{AB} \sim\perp \overline{BC}$ because their slopes are not opposite reciprocals. $ABCD$ is not a rectangle because $\angle ABC$ is not a right angle.

REF: 081038ge

17 ANS:

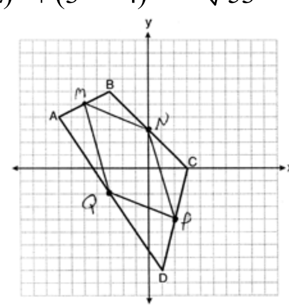
$M\left(\frac{-7+-3}{2}, \frac{4+6}{2}\right) = M(-5,5)$. $m_{\overline{MN}} = \frac{5-3}{-5-0} = \frac{2}{-5}$. Since both opposite sides have equal slopes and are parallel, $MNPQ$ is a parallelogram. $\overline{MN} = \sqrt{(-5-0)^2+(5-3)^2} = \sqrt{29}$. $\overline{MN}$ is not congruent to $\overline{NP}$, so $MNPQ$ is not a rhombus since not all sides are congruent.

$N\left(\frac{-3+3}{2}, \frac{6+0}{2}\right) = N(0,3)$ $\quad m_{\overline{PQ}} = \frac{-4--2}{2--3} = \frac{-2}{5}$

$P\left(\frac{3+1}{2}, \frac{0+-8}{2}\right) = P(2,-4)$ $\quad m_{\overline{NA}} = \frac{3--4}{0-2} = \frac{7}{-2}$

$Q\left(\frac{-7+1}{2}, \frac{4+-8}{2}\right) = Q(-3,-2)$ $\quad m_{\overline{QM}} = \frac{-2-5}{-3--5} = \frac{-7}{2}$

$\overline{NA} = \sqrt{(0-2)^2+(3--4)^2} = \sqrt{53}$



REF: 081338ge

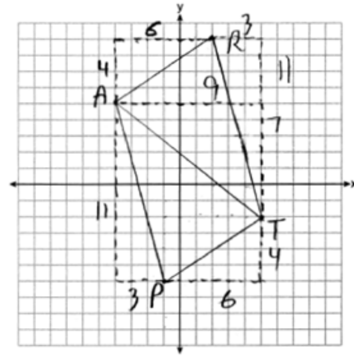
18 ANS:

$M\left(\frac{4+0}{2}, \frac{6-1}{2}\right) = M\left(2, \frac{5}{2}\right)$ $m = \frac{6--1}{4-0} = \frac{7}{4}$ $m_{\perp} = -\frac{4}{7}$ $y - 2.5 = -\frac{4}{7}(x-2)$ The diagonals, $\overline{MT}$ and $\overline{AH}$, of rhombus $MATH$ are perpendicular bisectors of each other.

REF: fall1411geo

19 ANS:

$\triangle PAT$ is an isosceles triangle because sides $\overline{AP}$ and $\overline{AT}$ are congruent ($\sqrt{3^2+11^2} = \sqrt{7^2+9^2} = \sqrt{130}$). $R(2,9)$. Quadrilateral $PART$ is a parallelogram because the opposite sides are parallel

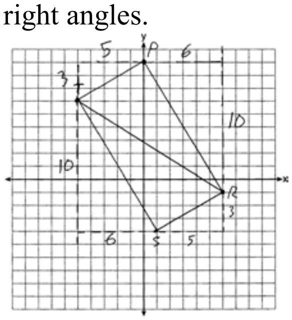


($m_{\overline{AR}} = \frac{4}{6} = \frac{2}{3}$; $m_{\overline{PT}} = \frac{4}{6} = \frac{2}{3}$; $m_{\overline{PA}} = -\frac{11}{3}$; $m_{\overline{RT}} = -\frac{11}{3}$)

REF: 011835geo

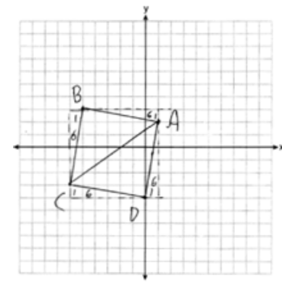
20 ANS:

$m_{\overline{TS}} = \frac{-10}{6} = -\frac{5}{3}$ $m_{\overline{SR}} = \frac{3}{5}$ Since the slopes of $\overline{TS}$ and $\overline{SR}$ are opposite reciprocals, they are perpendicular and form a right angle. $\triangle RST$ is a right triangle because $\angle S$ is a right angle. $P(0,9)$ $m_{\overline{RP}} = \frac{-10}{6} = -\frac{5}{3}$ $m_{\overline{PT}} = \frac{3}{5}$ Since the slopes of all four adjacent sides ($\overline{TS}$ and $\overline{SR}$, $\overline{SR}$ and $\overline{RP}$, $\overline{PT}$ and $\overline{TS}$, $\overline{RP}$ and $\overline{PT}$) are opposite reciprocals, they are perpendicular and form right angles. Quadrilateral $RSTP$ is a rectangle because it has four right angles.



REF: 061536geo

21 ANS:
$AB = \sqrt{(-5-1)^2 + (3-2)^2} = \sqrt{37}$, $BC = \sqrt{(-5--6)^2 + (3--3)^2} = \sqrt{37}$ (because $AB = BC$, $\triangle ABC$ is isosceles). $(0,-4)$. $AD = \sqrt{(1-0)^2 + (2--4)^2} = \sqrt{37}$, $CD = \sqrt{(-6-0)^2 + (-3--4)^2} = \sqrt{37}$, $m_{\overline{AB}} = \dfrac{3-2}{-5-1} = -\dfrac{1}{6}$, $m_{\overline{CB}} = \dfrac{3--3}{-5--6} = 6$ ($ABCD$ is a square because all four sides are congruent, consecutive sides are perpendicular since slopes are opposite reciprocals and so $\angle B$ is a right angle).



REF: 081935geo

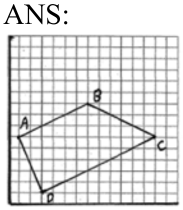
22 ANS:
$m_{\overline{AB}} = \left(\dfrac{-6+2}{2}, \dfrac{-2+8}{2}\right) = D(2,3)$ $m_{\overline{BC}} = \left(\dfrac{2+6}{2}, \dfrac{8+-2}{2}\right) = E(4,3)$ $F(0,-2)$. To prove that $ADEF$ is a parallelogram, show that both pairs of opposite sides of the parallelogram are parallel by showing the opposite sides have the same slope: $\mathrm{m}_{\overline{AD}} = \dfrac{3--2}{-2--6} = \dfrac{5}{4}$ $\overline{AF} \parallel \overline{DE}$ because all horizontal lines have the same slope. $ADEF$

$$\mathrm{m}_{FE} = \frac{3--2}{4-0} = \frac{5}{4}$$

is not a rhombus because not all sides are congruent. $AD = \sqrt{5^2 + 4^2} = \sqrt{41}$ $AF = 6$

REF: 081138ge

23 ANS:

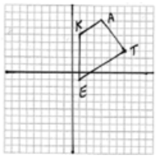


. To prove that $ABCD$ is a trapezoid, show that one pair of opposite sides of the figure is parallel by showing they have the same slope and that the other pair of opposite sides is not parallel by showing they do not have the same slope: $m_{\overline{AB}} = \dfrac{9-6}{7-1} = \dfrac{3}{6} = \dfrac{1}{2}$ $m_{\overline{AD}} = \dfrac{6-1}{1-3} = -\dfrac{5}{2}$

$$m_{\overline{CD}} = \frac{6-1}{13-3} = \frac{5}{10} = \frac{1}{2} \quad m_{\overline{BC}} = \frac{9-6}{7-13} = -\frac{3}{6} = -\frac{1}{2}$$

REF: 080134b

24 ANS:



. To prove that *KATE* is a trapezoid, show that one pair of opposite sides of the figure is parallel by showing they have the same slope and that the other pair of opposite sides is not parallel by showing they do not have the same slope: $m_{\overline{AK}} = \dfrac{7-5}{4-1} = \dfrac{2}{3}$ $\quad m_{\overline{EK}} = \dfrac{-1-5}{1-1} = \text{undefined}$

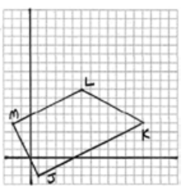
$$m_{\overline{ET}} = \frac{3-(-1)}{7-1} = \frac{4}{6} = \frac{2}{3} \quad m_{\overline{AT}} = \frac{7-3}{4-7} = -\frac{4}{3}$$

To prove that a trapezoid is not an isosceles trapezoid, show that the opposite sides that are not parallel are also not congruent using the distance formula: $\mathrm{d}_{\overline{EK}} = \sqrt{(1-1)^2 + (5-(-1))^2} = 6$

$$\mathrm{d}_{\overline{AT}} = \sqrt{(4-7)^2 + (7-3)^2} = 5$$

REF: 010333b

25 ANS:



. To prove that *JKLM* is a trapezoid, show that one pair of opposite sides of the figure is parallel by showing they have the same slope and that the other pair of opposite sides is not parallel by showing they do not have the same slope: $m_{\overline{JK}} = \dfrac{4-(-2)}{13-1} = \dfrac{1}{2}$ $m_{\overline{JM}} = \dfrac{-2-4}{1-(-2)} = -2$

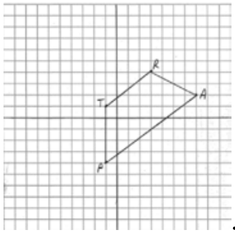
$$m_{\overline{LM}} = \frac{8-4}{6-(-2)} = \frac{1}{2} \quad m_{\overline{KL}} = \frac{4-8}{13-6} = -\frac{4}{7}$$

To prove that a trapezoid is not an isosceles trapezoid, show that the opposite sides that are not parallel are also not congruent using the distance formula: $d_{\overline{JM}} = \sqrt{(1-(-2))^2 + (-2-4)^2} = \sqrt{45}$

$$d_{\overline{KL}} = \sqrt{(13-6)^2 + (4-8)^2} = \sqrt{65}$$

REF: 080434b

26 ANS:



. To prove that *TRAP* is a trapezoid, show that one pair of opposite sides of the figure is parallel by showing they have the same slope and that the other pair of opposite sides is not parallel by showing they do not have the same slope: $m_{\overline{TR}} = \dfrac{1-4}{-1-3} = \dfrac{3}{4}$ $m_{\overline{TP}} = \dfrac{1-(-4)}{-1-(-1)} = \text{undefined}$

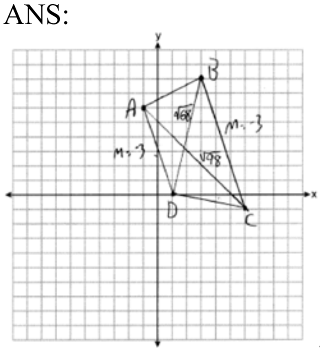
$$m_{\overline{PA}} = \frac{-4-2}{-1-7} = \frac{3}{4} \quad m_{\overline{RA}} = \frac{4-2}{3-7} = -\frac{1}{2}$$

To prove that a trapezoid is not an isosceles trapezoid, show that the opposite sides that are not parallel are also not congruent using the distance formula: $d_{\overline{TP}} = \sqrt{(-1-(-1))^2 + (1-(-4))^2} = 5$

$$d_{\overline{RA}} = \sqrt{(3-7)^2 + (4-2)^2} = \sqrt{20} = 2\sqrt{5}$$

REF: 080933b

27 ANS:



$m_{\overline{AD}} = \dfrac{0-6}{1--1} = -3$ $\overline{AD} \parallel \overline{BC}$ because their slopes are equal. *ABCD* is a trapezoid

$m_{\overline{BC}} = \dfrac{-1-8}{6-3} = -3$

because it has a pair of parallel sides. $AC = \sqrt{(-1-6)^2 + (6--1)^2} = \sqrt{98}$ *ABCD* is not an isosceles trapezoid

$$BD = \sqrt{(8-0)^2 + (3-1)^2} = \sqrt{68}$$

because its diagonals are not congruent.

REF: 061932geo

28 ANS:

To prove that *ABCD* is a trapezoid, show that one pair of opposite sides of the figure is parallel by showing they have the same slope and that the other pair of opposite sides is not parallel by showing they do not have the same slope: $m_{\overline{AB}} = \dfrac{0-0}{-a-a} = \dfrac{0}{-2a} = 0$ $m_{\overline{AD}} = \dfrac{c-0}{-b-(-a)} = \dfrac{c}{-b+a}$ If $\overline{AD}$ and $\overline{BC}$ are parallel, then: $\dfrac{c}{-b+a} = \dfrac{c}{b-a}$

$$m_{\overline{CD}} = \frac{c-c}{-b-b} = \frac{0}{-2b} = 0 \quad m_{\overline{BC}} = \frac{c-0}{b-a} = \frac{c}{b-a}$$

$$c(b-a) = c(-b+a)$$
$$b-a = -b+a$$
$$2a = 2b$$
$$a = b$$

But the facts of the problem indicate $a \neq b$, so $\overline{AD}$ and $\overline{BC}$ are not parallel.

To prove that a trapezoid is an isosceles trapezoid, show that the opposite sides that are not parallel are congruent using the distance formula: $d_{\overline{BC}} = \sqrt{(b-a)^2 + (c-0)^2}$ $d_{\overline{AD}} = \sqrt{(-b-(-a))^2 + (c-0)^2}$

$$d_{\overline{BC}} = \sqrt{b^2 - 2ab + a^2 + c^2} = \sqrt{a^2 + b^2 - 2ab + c^2}$$

$$d_{\overline{AD}} = \sqrt{(a-b)^2 + c^2} = \sqrt{a^2 - 2ab + b^2 + c^2} = \sqrt{a^2 + b^2 - 2ab + c^2}$$

REF: 080534b