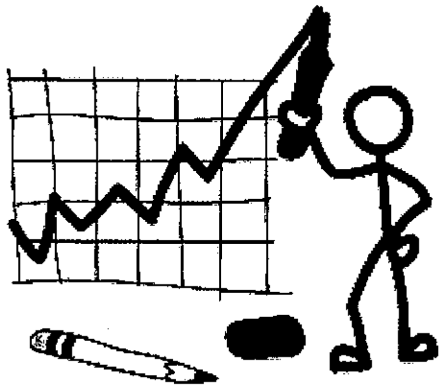


Geometry

Unit 4-12

Coordinate Geometry Proofs

Lesson 1 Triangle Proofs

Example 1:

The vertices of ΔABC are A(-2, 4) B(-2, 8) and C(-5, 6).
Prove ΔABC is isosceles.

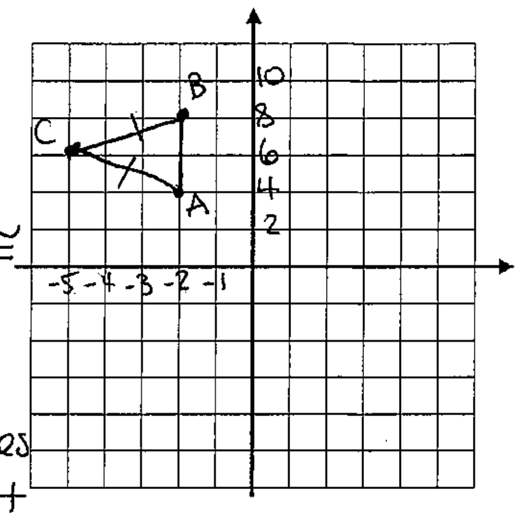
$CB = \sqrt{(-5 - -2)^2 + (6-8)^2}$

$= \sqrt{9+4} = \sqrt{13}$

$\cong$

$AC = \sqrt{(-2 - -5)^2 + (4-6)^2}$

$= \sqrt{9+4} = \sqrt{13}$



$\cong$ segments have $=$ distances

ΔABC is an isosceles triangle because it has 2 $\cong$ sides.

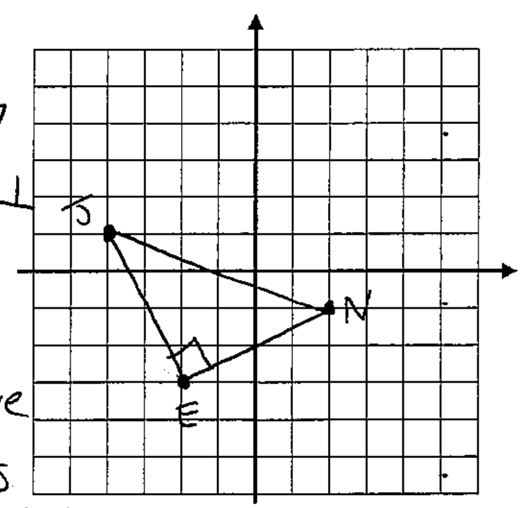
Example 2:

The vertices of ΔJEN are J(-4, 1) E(-2, -3) and N(2, -1).
Prove ΔJEN is a right triangle.

$m\overline{JE} = \dfrac{1 - -3}{-4 - -2} = \dfrac{4}{-2} = -2$

$\perp$

$m\overline{EN} = \dfrac{-3 - -1}{-2 - 2} = \dfrac{-2}{-4} = \dfrac{1}{2}$



Perpendicular lines have neg. reciprocal slopes and they form a right ∡. ΔJEN is a right triange because it has a right ∡, ∠JEN.

HW

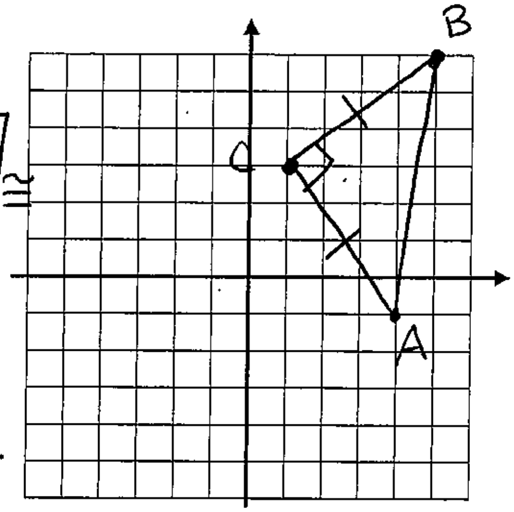
Example 3:

Prove that A(4,-1), B(5,6), C(1,3) is an isosceles right triangle.

$BC=\sqrt{(5-1)^2+(6-3)^2}$
$=\sqrt{16+9}=\sqrt{25}=5$

$AC=\sqrt{(4-1)^2+(-1-3)^2}$
$=\sqrt{9+16}=\sqrt{25}=5$

$\cong$



$m\overline{BC}=\frac{6-3}{5-1}=\frac{3}{4}$

$m\overline{AC}=\frac{-1-3}{4-1}=\frac{-4}{3}$

$\perp$

$\triangle ABC$ is an isosceles right $\triangle$ because it has 2 $\cong$ sides, $\overline{BC}\cong\overline{AC}$, and a right $\measuredangle$ because $\overline{BC}\perp\overline{AC}$ (their slopes are neg. reciprocals)

Example 4:

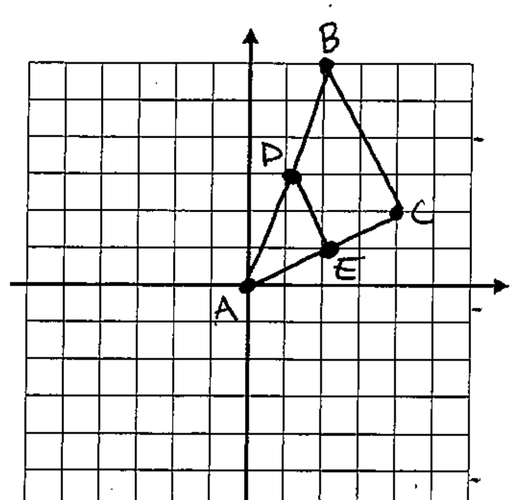
The coordinates of $\triangle ABC$ are A(0,0), B(2,6), and C(4,2). Using coordinate geometry, prove that if the midpoints of sides $\overline{AB}$ and $\overline{AC}$ are joined, the segment formed is parallel to the third side and equal to one-half the length of the third side.

midpt $\overline{AB}=\left(\frac{0+2}{2},\frac{0+6}{2}\right)$

$D=(1,3)$

midpt $\overline{AC}=\left(\frac{0+4}{2},\frac{0+2}{2}\right)$

$E=(2,1)$



$m\overline{BC}=\frac{6-2}{2-4}=\frac{4}{-2}=-2$

$m\overline{DE}=\frac{3-1}{1-2}=\frac{2}{-1}=-2$

$\parallel$

The midpt of $\overline{AB}$ is D(1,3) and the midpt of $\overline{AC}$ is E(2,1). The segment joining the midpoints, $\overline{DE}$, is $\parallel$ to the 3rd side $\overline{BC}$ b/c 2 they have = slopes

HW

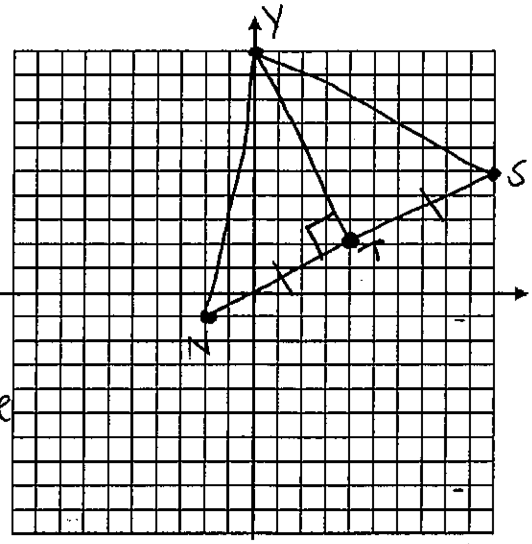
Example 5:

The vertices of $\triangle NYS$ are N(-2,-1), Y(0,10), and S(10,5). The coordinates of point T are (4,2).

(a) Prove that $\overline{YT}$ is a median.

(b) Prove that $\overline{YT}$ is an altitude.

(c) Find the area of $\triangle NYS$.



a) mdpt $\overline{NS} = \left(\frac{-2+10}{2}, \frac{-1+5}{2}\right)$

$= (4,2) = T$

$\overline{YT}$ is a median because T is the midpoint of $\overline{NS}$

b) $m\overline{YT} = \frac{10-2}{0-4} = \frac{8}{-4} = -2$

$m\overline{NS} = \frac{5-^-1}{10-^-2} = \frac{6}{12} = \frac{1}{2}$

$\perp$

Perpendicular lines have neg. reciprocal slopes and form rt. ∡'s. $\overline{YT}$ is an altitude because it is $\perp$ to $\overline{NS}$ and they share point T.

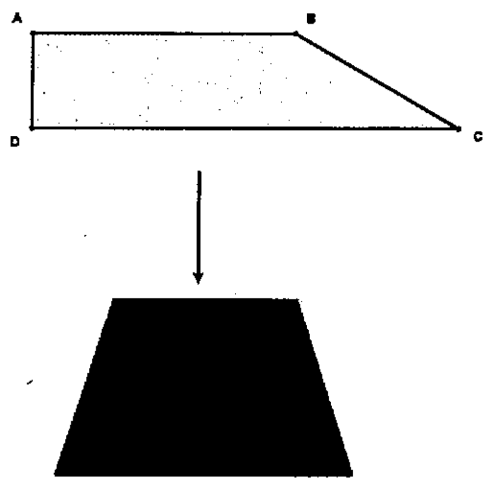
c) $YT = \sqrt{(0-4)^2+(10-2)^2} = \sqrt{16+64} = \sqrt{80} = h$

$NS = \sqrt{(-2-10)^2+(-1-5)^2} = \sqrt{144+36} = \sqrt{180} = b$

$A\triangle = \frac{1}{2}bh = \frac{1}{2}(\sqrt{80})(\sqrt{180}) = \frac{1}{2}\sqrt{14400} = \frac{1}{2}(120) = 60$

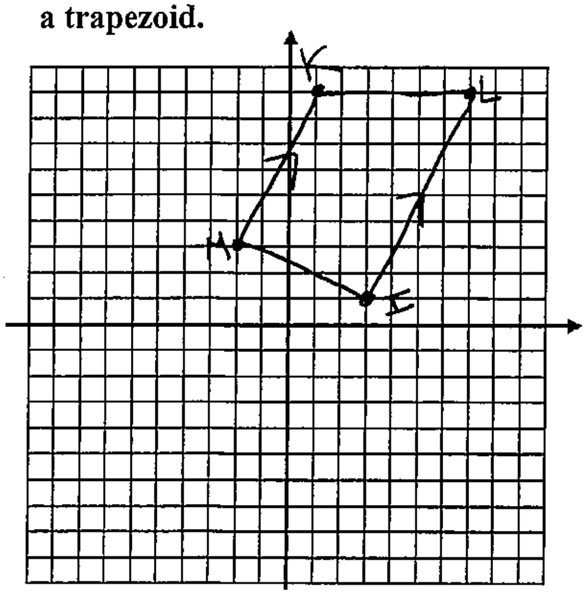
Unit 12 Lesson 2

Trapezoid and Isosceles Trapezoid



Example 1

Prove that quadrilateral MILK with the vertices M(-2,3), I(3, 1), L(7, 9), and K(1, 9) is a trapezoid.



$$m\overline{MK} = \frac{9-3}{1--2} = \frac{6}{3} = 2$$

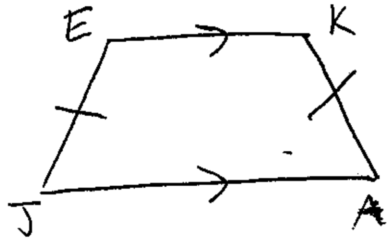
$$m\overline{IL} = \frac{9-1}{7-3} = \frac{8}{4} = 2$$

||

Quad. MILK is a trapezoid because it has one pair of || sides. $\overline{MK} \parallel \overline{IL}$ because they have equal slopes.

Example 2

Quadrilateral JAKE has coordinates
J(0, 3a), A(3a, 3a), K(4a, 0) and E(-a, 0).



Prove by coordinate geometry that
quadrilateral JAKE is an isosceles trapezoid.

$$m\overline{JA} = \frac{3a-3a}{0-3a} = \frac{0}{-3a} = 0$$

$$m\overline{KE} = \frac{0-0}{4a-{-a}} = \frac{0}{5a} = 0$$

$\parallel$

$$EJ = \sqrt{(0-{-a})^2+(3a-0)^2} = \sqrt{a^2+9a^2} = \sqrt{10a^2}$$

$$AK = \sqrt{(3a-4a)^2+(3a-0)^2} = \sqrt{a^2+9a^2} = \sqrt{10a^2}$$

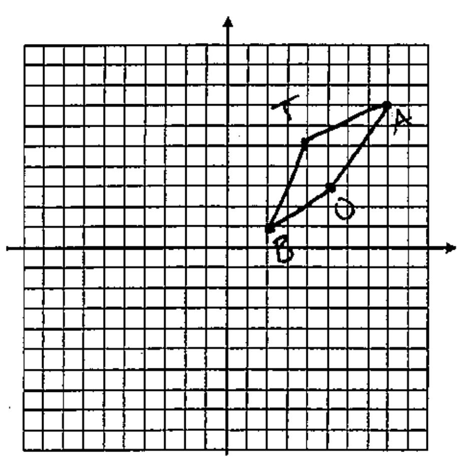
$\cong$

Parallel lines have = slopes + $m\overline{JA} = m\overline{KE}$ so $\overline{JA} \parallel \overline{KE}$. ≅ seg. have = distances & EJ=AK, so $\overline{EJ} \cong \overline{AK}$. Quad. JAKE is an isos. trap. because it has 1 pair of ∥ sides & non-∥ sides are ≅.

Example 3

Quadrilateral BOAT has coordinates
B(2, 1), O(6, 3), A(8, 7) and T(4, 5).

Prove by coordinate geometry that the diagonals of BOAT bisect each other.



$$\text{midpt } \overline{BA} = \left(\frac{2+8}{2}, \frac{1+7}{2}\right) = (5, 4)$$

$$\text{midpt } \overline{TO} = \left(\frac{6+4}{2}, \frac{3+5}{2}\right) = (5, 4)$$

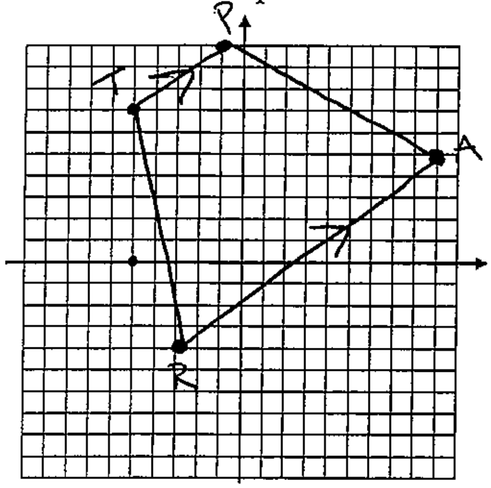
$=$

since midpt $\overline{BA}$ = midpt $\overline{TO}$ + segments that bisect each other have the same midpts, then the diagonals of BOAT bisect each other.

HW

Example 4

Given quadrilateral TRAP with coordinates T(-5, 7), R(-3, -4) and A(9, 5). Determine and state coordinates of P that would make TRAP a trapezoid. Then prove, using coordinate geometry that TRAP is a trapezoid.



$m\overline{RA} = \frac{-4-5}{-3-9} = \frac{-9}{-12} = \frac{3}{4}$

*count w/ slope from T ∥

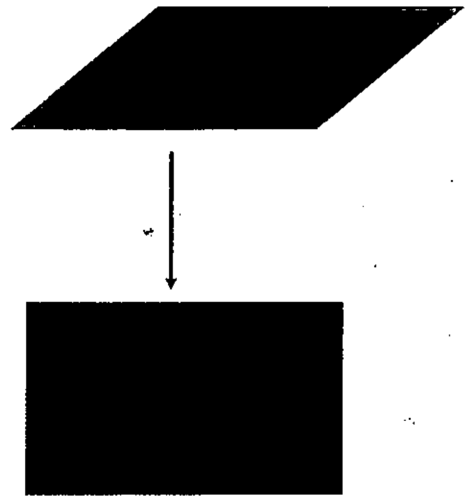
$P(-1, 10)$

$m\overline{TP} = \frac{7-10}{-5-1} = \frac{-3}{-4} = \frac{3}{4}$

The $m\overline{RA} = m\overline{TP}$ & parallel lines have equal slopes. TRAP is a trapezoid because it has one pair of ∥ sides.

Unit 12 Lesson 3

Parallelogram and Rectangle



Example 1

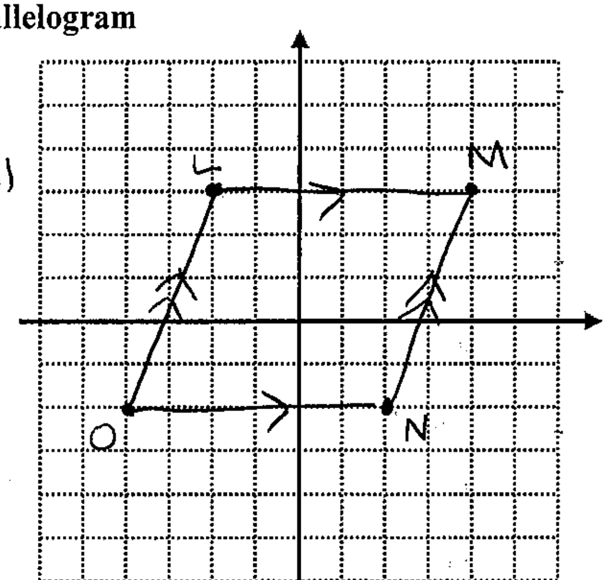
Prove that the quadrilateral with the coordinates L(-2,3), M(4,3), N(2,-2) and O(-4,-2) is a parallelogram

$m\overline{LM} = \frac{3-3}{-2-4} = 0$

$m\overline{ON} = \frac{-2 - -2}{-4-2} = 0$ ∥

$m\overline{LO} = \frac{3 - -2}{-2 - -4} = \frac{5}{2}$

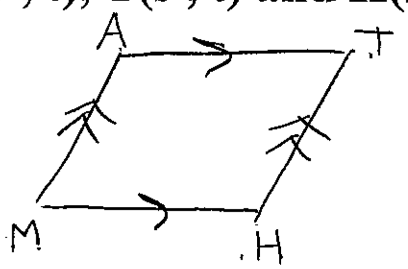
$m\overline{MN} = \frac{3 - -2}{4-2} = \frac{5}{2}$ ∥



The $m\overline{LM} = m\overline{ON}$ + $m\overline{LO} = m\overline{MN}$ + parallel lines have = slopes so $\overline{LM} \parallel \overline{ON}$ + $\overline{LO} \parallel \overline{MN}$. Quad. LMNO is a parallelogram because it has 2 pairs of ∥ sides.

Example 2

Prove that the quadrilateral with the coordinates M(0 , 0), A(r , t), T(s , t) and H(s - r, 0) is a parallelogram.



$m\overline{HT} = \frac{t-0}{s-(s-r)} = \frac{t}{r}$

$m\overline{MA} = \frac{0-t}{0-r} = \frac{t}{r}$ $\parallel$

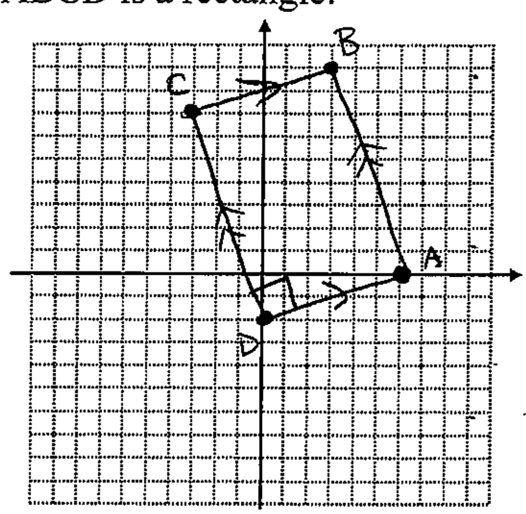
$m\overline{MH} = \frac{0-0}{0-(s-r)} = 0$

$m\overline{AT} = \frac{t-t}{r-s} = 0$ $\parallel$

Since $m\overline{HT} = m\overline{MA}$ & $m\overline{MH} = m\overline{AT}$ & parallel lines have = slopes, then $\overline{HT} \parallel \overline{MA}$ & $\overline{MH} \parallel \overline{AT}$. MATH is a parallelogram b/c it has 2 pairs of $\parallel$ sides.

Example 3

Quadrilateral ABCD has vertices A(6, 0), B(3, 9), C(-3, 7) and D(0, -2). Prove that ABCD is a rectangle.



$m\overline{BC} = \frac{9-7}{3-{-3}} = \frac{2}{6} = \frac{1}{3}$

$m\overline{AD} = \frac{0-{-2}}{6-0} = \frac{2}{6} = \frac{1}{3}$ $\parallel$

$\perp$

$m\overline{CD} = \frac{7-{-2}}{-3-0} = \frac{9}{-3} = -3$

$m\overline{AB} = \frac{0-9}{6-3} = \frac{-9}{3} = -3$ $\parallel$

Since $m\overline{BC} = m\overline{AD}$ & $m\overline{CD} = m\overline{AB}$ & parallel lines have = slopes, then $\overline{BC} \parallel \overline{AD}$ & $\overline{CD} \parallel \overline{AB}$. Since $m\overline{AD}$ & $m\overline{CD}$ are (-) rec. & $\perp$ lines have (-) rec. slopes, then $\overline{AD} \perp \overline{CD}$. Quad. ABCD is a rectangle b/c it has 2 pairs of $\parallel$ sides & a rt. $\angle$.

HW

Example 4

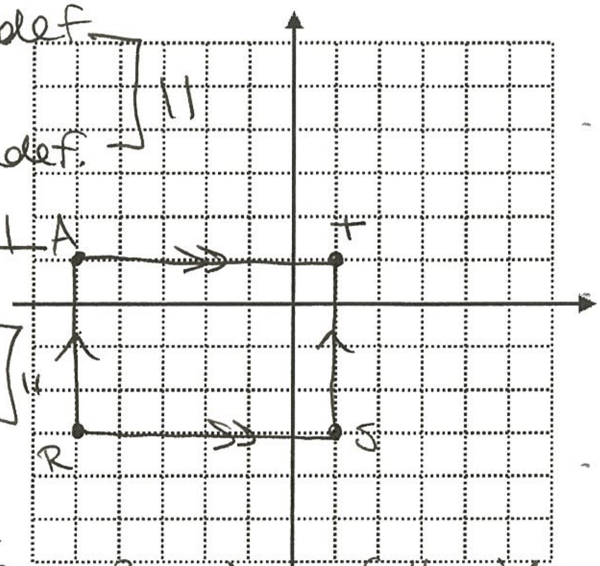
Prove that quadrilateral RATS is a rectangle.
R(-5, -3) A(-5, 1) T(1, 1) S(1, -3)

$m\overline{RA} = \frac{1 - -3}{-5 - -5} = \frac{4}{0} = \text{undef.}$

$m\overline{TS} = \frac{-3-1}{1-1} = \frac{-4}{0} = \text{undef.}$ ∥

$m\overline{AT} = \frac{1-1}{-5-1} = \frac{0}{-6} = 0$ ⊥

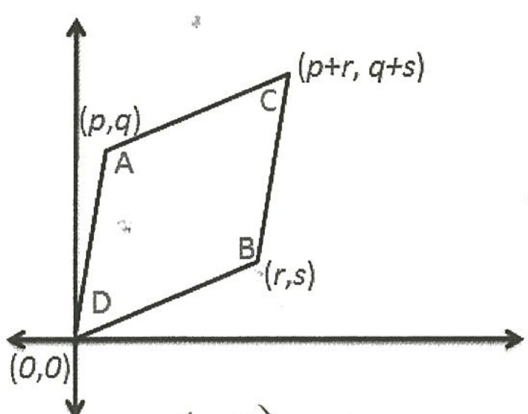
$m\overline{RS} = \frac{-3 - -3}{-5-1} = \frac{0}{-6} = 0$ ∥



Quad. RATS is a rectangle b/c it has 2 pairs of ∥ sides & a rt. ∡

Example 5

Is quadrilateral ABCD is a rectangle? Prove it.



$m\overline{AC} = \frac{q-(q+s)}{p-(p+r)} = \frac{s}{r}$

$m\overline{AD} = \frac{q-0}{p-0} = \frac{q}{p}$

$m\overline{BC} = \frac{s-(q+s)}{r-(p+r)} = \frac{q}{p}$

$m\overline{BD} = \frac{s-0}{r-0} = \frac{s}{r}$

Since none of the slopes are neg. recip. then $\overline{AC}$ is not ⊥ to $\overline{AD}$. Quad. ABCD is not a rectangle b/c it does not have a rt ∡

HW

Example 6

Prove that the quadrilateral with coordinates R(0,5), S(3,4), T(0,-5) and U(-3,-4) is a parallelogram.

$m\overline{RS} = \frac{5-4}{0-3} = \frac{1}{-3}$

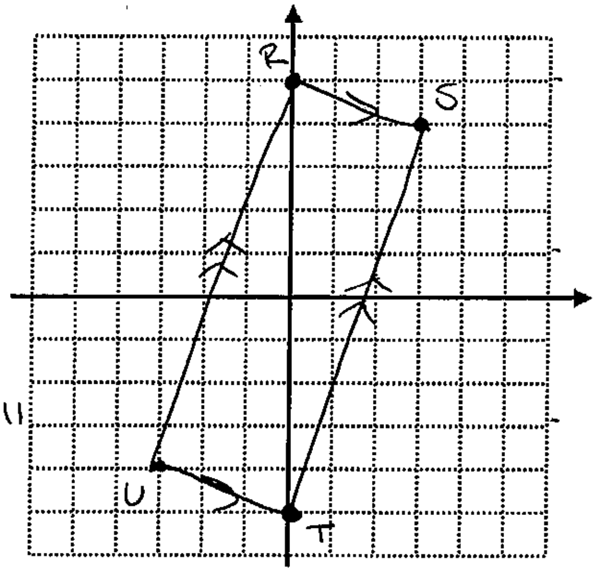
$m\overline{TU} = \frac{-5-4}{0--3} = \frac{-1}{3}$

∥

$m\overline{RU} = \frac{5--4}{0--3} = \frac{9}{3} = 3$

$m\overline{ST} = \frac{4--5}{3-0} = \frac{9}{3} = 3$

∥

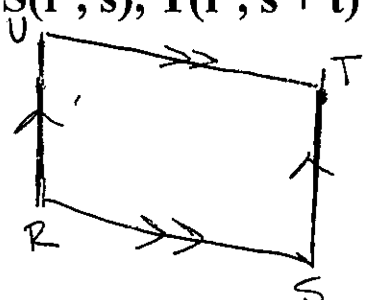


Quad. RSTU is a parallelogram b/c it has 2 pairs of ∥ sides ($\overline{RS} \parallel \overline{TU}$ & $\overline{RU} \parallel \overline{ST}$)

HW

Example 7

Prove that the quadrilateral with the coordinates R(0 , 0), S(r , s), T(r , s + t) and U(0 , t) is a parallelogram.



$m\overline{RS} = \frac{s-0}{r-0} = \frac{s}{r}$

$m\overline{TU} = \frac{t-(s+t)}{0-r} = \frac{-s}{-r} = \frac{s}{r}$

∥

$m\overline{ST} = \frac{s-(s+t)}{r-r} = \frac{-t}{0} = \text{undefined}$

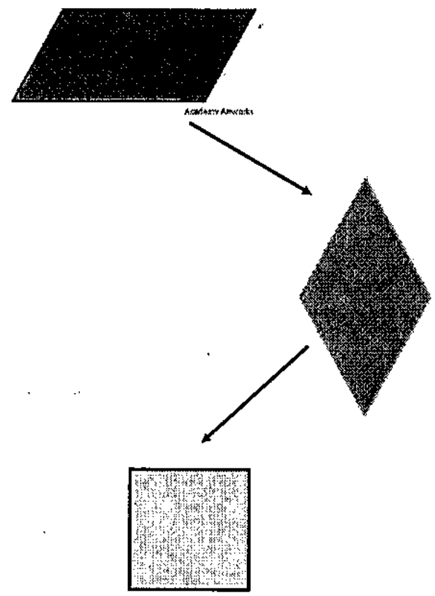
$m\overline{RU} = \frac{t-0}{0-0} = \frac{t}{0} = \text{undefined}$

∥

Quad. RSTU is a parallelogram b/c it has 2 pairs of ∥ sides.

Unit 12 Lesson 4

Rhombus and Square



Example 1

Prove that a quadrilateral with the vertices A(-2,3), B(2,6), C(7,6) and D(3,3) is a rhombus.

$m\overline{BD} = \frac{6-3}{2-3} = \frac{3}{-1} = -3$

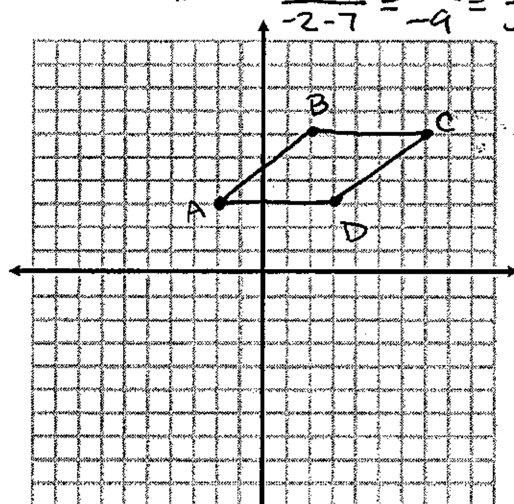
$m\overline{AC} = \frac{3-6}{-2-7} = \frac{-3}{-9} = \frac{1}{3}$ $\perp$

$m\overline{AB} = \frac{3-6}{-2-2} = \frac{-3}{-4} = \frac{3}{4}$

$m\overline{CD} = \frac{6-3}{7-3} = \frac{3}{4}$ $\parallel$

$m\overline{BC} = \frac{6-6}{7-2} = 0$

$m\overline{AD} = \frac{3-3}{-2-3} = 0$ $\parallel$



Quad. ABCD is a rhombus b/c it has 2 pairs of $\parallel$ sides & $\perp$ diagonals

Example 2

Prove that the quadrilateral with vertices P(0,0), A(4,3), R(7,-1) and K(3,-4) is a square

$m\overline{PA} = \frac{3-0}{4-0} = \frac{3}{4}$

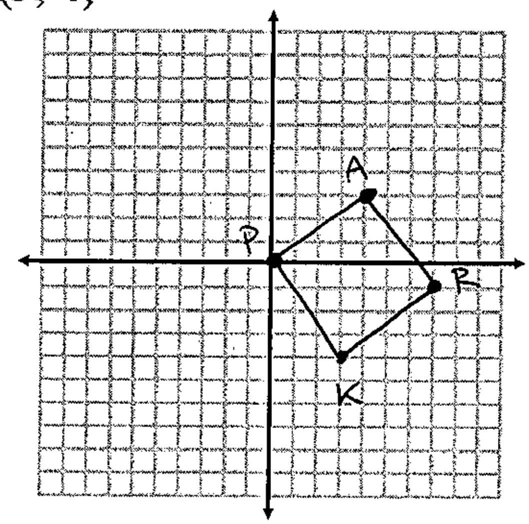
$m\overline{RK} = \frac{-1--4}{7-3} = \frac{3}{4}$ ∥

$m\overline{AR} = \frac{3--1}{4-7} = \frac{4}{-3}$ ⊥

$m\overline{PK} = \frac{0--4}{0-3} = \frac{4}{-3}$ ∥

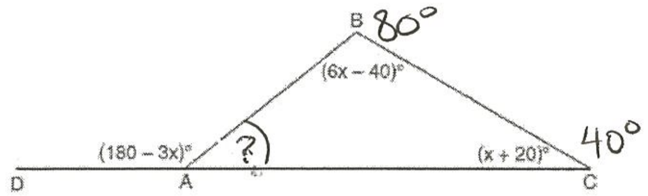
$m\overline{PR} = \frac{-1-0}{7-0} = -\frac{1}{7}$

$m\overline{AK} = \frac{3--4}{4-3} = \frac{7}{1}$ ⊥



Quad. PART is a square b/c it has 2 pairs of ∥ sides, ⊥ diagonals, & a rt. ∠.

70 In $\triangle ABC$ shown below, side $\overline{AC}$ is extended to point D with $m\angle DAB = (180 - 3x)°$, $m\angle B = (6x - 40)°$, and $m\angle C = (x + 20)°$.



What is $m\angle BAC$?
1) 20°
2) 40°
3) 60°
4) 80°

$6x - 40 + x + 20 = 180 - 3x$

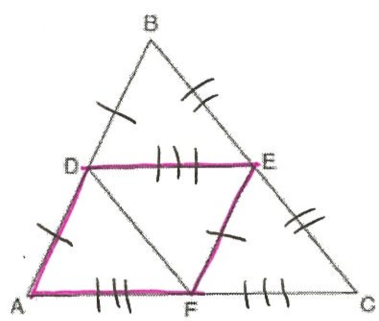
$7x - 20 = 180 - 3x$

$10x = 200$

$x = 20$

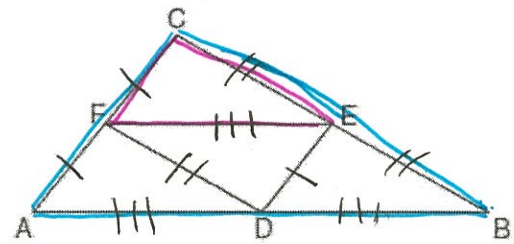
G.CO.C.10: MIDSEGMENTS

71 In the diagram below, $\overline{DE}$, $\overline{DF}$, and $\overline{EF}$ are midsegments of $\triangle ABC$.



The perimeter of quadrilateral $ADEF$ is equivalent to
1) $AB + BC + AC$
2) $\frac{1}{2}AB + \frac{1}{2}AC$
3) $2AB + 2AC$
4) $AB + AC$

72 In the diagram below of $\triangle ABC$, D, E, and F are the midpoints of $\overline{AB}$, $\overline{BC}$, and $\overline{CA}$, respectively.



What is the ratio of the area of $\triangle CFE$ to the area of $\triangle CAB$?
1) 1:1
2) 1:2
3) 1:3
4) 1:4

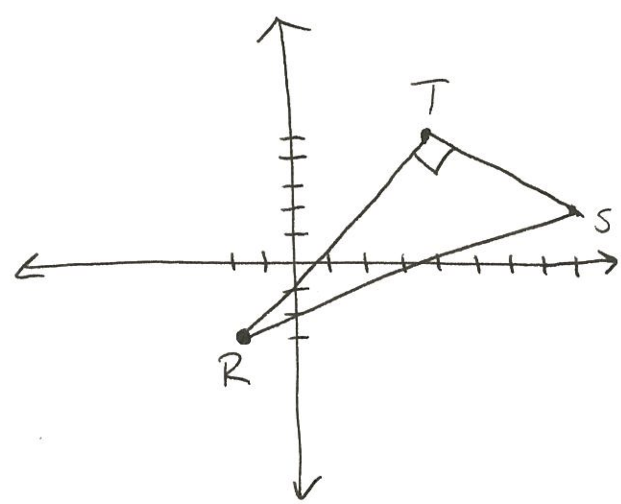
G.GPE.B.4: TRIANGLES IN THE COORDINATE PLANE

73 The coordinates of the vertices of $\triangle RST$ are $R(-2,-3)$, $S(8,2)$, and $T(4,5)$. Which type of triangle is $\triangle RST$?
1) right
2) acute
3) obtuse
4) equiangular

$m\overline{ST} = \frac{5-2}{4-8} = \frac{3}{-4}$

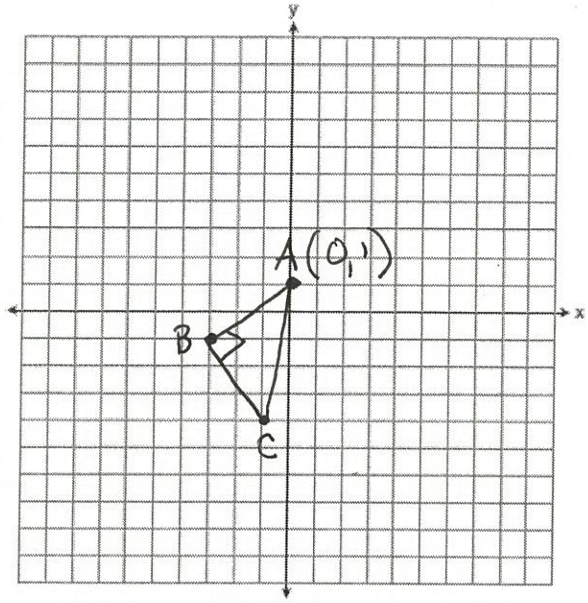
$m\overline{RT} = \frac{-3-5}{-2-4} = \frac{4}{3}$

$\perp$



13

74 Triangle ABC has vertices with $A(x,3)$, $B(-3,-1)$, and $C(-1,-4)$. Determine and state a value of x that would make triangle ABC a right triangle. Justify why $\triangle ABC$ is a right triangle. [The use of the set of axes below is optional.]



$m\overline{BC} = \frac{-1 - -4}{-3 - -1} = \frac{3}{-2}$

(−) rec.

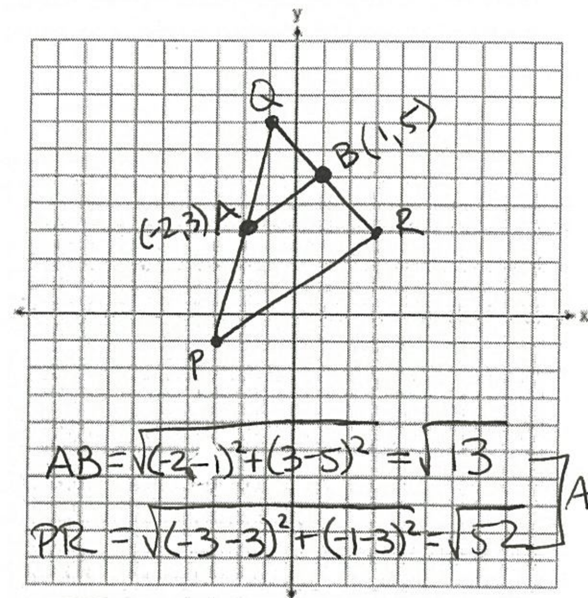
slope $\overline{AB} = \frac{2}{3}$

$\boxed{x = 0}$

$m\overline{AB} = \frac{3-1}{0 - -3} = \frac{2}{3}$

$\triangle ABC$ is a right $\triangle$ b/c it has a right $\angle ABC$. The slopes of $\overline{BC}$ & $\overline{AB}$ are neg rec., so they are $\perp$.

75 Triangle PQR has vertices $P(-3,-1)$, $Q(-1,7)$, and $R(3,3)$, and points A and B are midpoints of $\overline{PQ}$ and $\overline{RQ}$, respectively. Use coordinate geometry to prove that $\overline{AB}$ is parallel to $\overline{PR}$ and is half the length of $\overline{PR}$. [The use of the set of axes below is optional.]



$AB = \sqrt{(-2-1)^2 + (3-5)^2} = \sqrt{13}$

$PR = \sqrt{(-3-3)^2 + (-1-3)^2} = \sqrt{52}$

$AB = \frac{1}{2} PR$

$m\overline{AB} = \frac{3-5}{-2-1} = \frac{-2}{-3} = \frac{2}{3}$

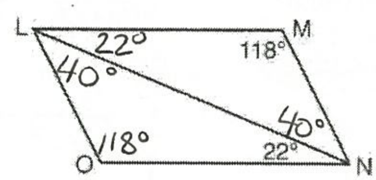
$m\overline{PR} = \frac{-1-3}{-3-3} = \frac{-4}{-6} = \frac{2}{3}$

$\parallel$ parallel lines have the same slope

POLYGONS

G.CO.C.11: INTERIOR AND EXTERIOR ANGLES OF POLYGONS

76 The diagram below shows parallelogram $LMNO$ with diagonal $\overline{LN}$, $m\angle M = 118°$, and $m\angle LNO = 22°$.



Explain why $m\angle NLO$ is 40 degrees.

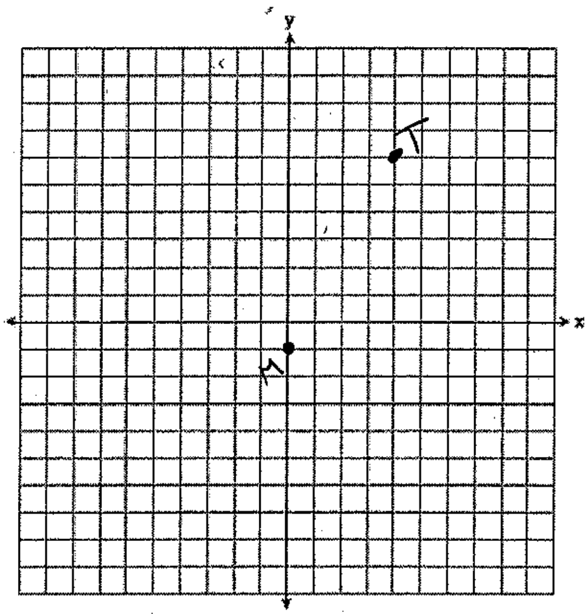
$\angle LON$ is 118° b/c opp. $\angle$'s of a parallelogram are $\cong$. A $\triangle$'s $\angle$ measures add up to 180°: 118 + 22 = 140 so $\angle NLO$ must be 40 degrees.

14

G.GPE.B.4: QUADRILATERALS IN THE COORDINATE PLANE

93 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 $\overline{AH}$.

* sep. sheet

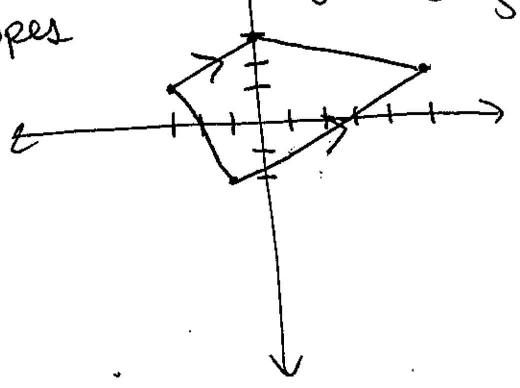


94 A quadrilateral has vertices with coordinates (−3,1), (0,3), (5,2), and (−1,−2). Which type of quadrilateral is this?
1) rhombus
2) rectangle
3) square
4) trapezoid

*check all slopes

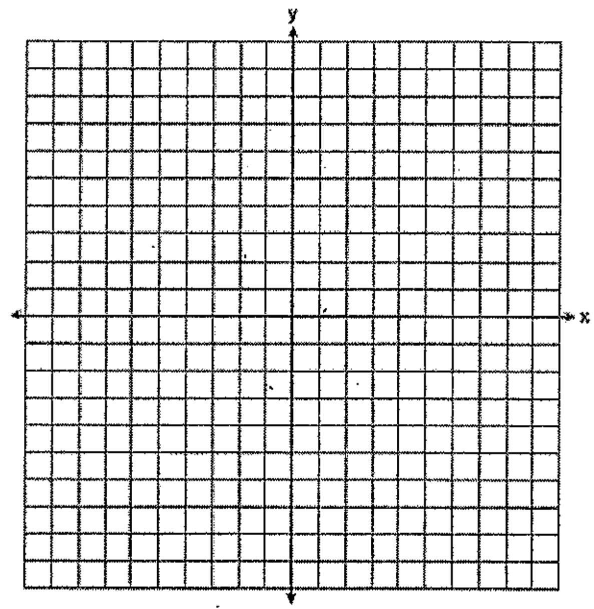
$\frac{-2-1}{-1-3}=\frac{-3}{2}$ $\frac{3-2}{0-5}=-\frac{1}{5}$

$\frac{3-1}{0-3}=\frac{2}{3}$ $\frac{2-{-2}}{5-1}=\frac{4}{6}=\frac{2}{3}$



95 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.]

*sep. sheet



96 The diagonals of rhombus *TEAM* intersect at $P(2,1)$. If the equation of the line that contains diagonal $\overline{TA}$ is $y=-x+3$, what is the equation of a line that contains diagonal $\overline{EM}$?
1) $y=x-1$
2) $y=x-3$
3) $y=-x-1$
4) $y=-x-3$

Pt. (2,1)
$m=1$
$y-1=1(x-2)$
$y=x-1$

15

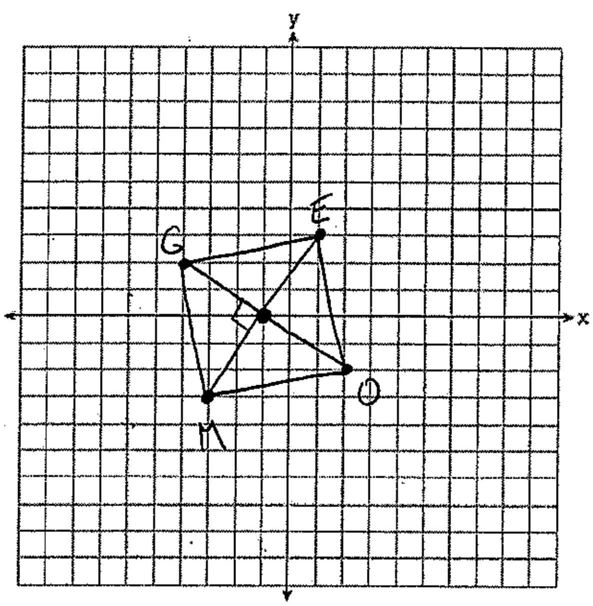
97 Parallelogram $ABCD$ has coordinates $A(0,7)$ and $C(2,1)$. Which statement would prove that $ABCD$ is a rhombus?

1) The midpoint of $\overline{AC}$ is $(1,4)$.
2) The length of $\overline{BD}$ is $\sqrt{40}$.
3) The slope of $\overline{BD}$ is $\frac{1}{3}$.
4) The slope of $\overline{AB}$ is $\frac{1}{3}$.

$m\overline{AC} = \frac{7-1}{0-2} = \frac{6}{-2} = -3$

*rhombus has $\perp$ diagonals

98 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.]



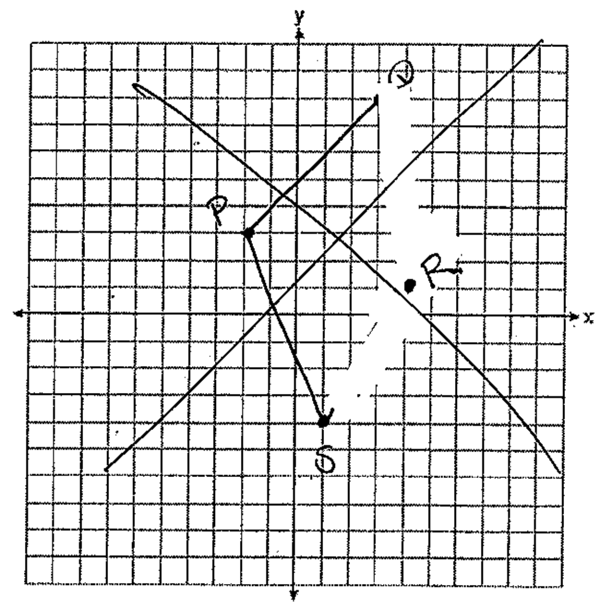
*diagonals of square are $\perp$ bisectors

$m\overline{GO} = \frac{-2-2}{2-4} = \frac{-4}{6} = -\frac{2}{3} \rightarrow m\overline{EM} = \frac{3}{2}$

$\text{midpt } \overline{GO} = \left(\frac{2-4}{2}, \frac{-2+2}{2}\right) = (-1,0)$

$\boxed{E(1,3) \text{ \& } M(-3,-3)}$

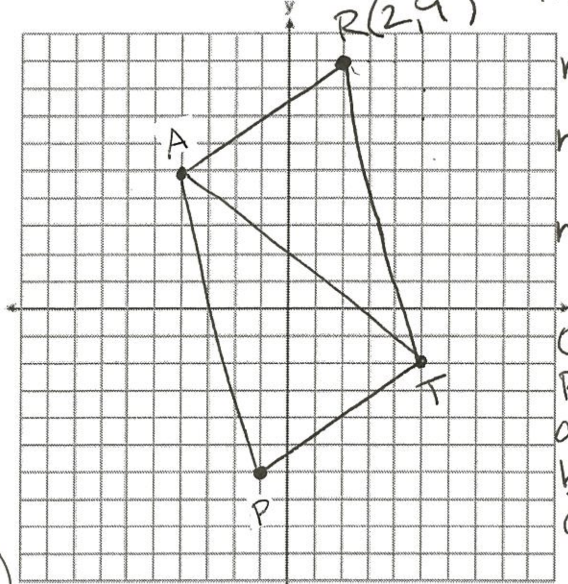
99 Quadrilateral $PQRS$ has vertices $P(-2,3)$, $Q(3,8)$, $R(4,1)$, and $S(-1,-4)$. Prove that $PQRS$ is a rhombus. Prove that $PQRS$ is *not* a square. [The use of the set of axes below is optional.]



* 99 sep. sheet

16

100 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. [The use of the set of axes below is optional.] State the coordinates of R so that quadrilateral $PART$ is a parallelogram. Prove that quadrilateral $PART$ is a parallelogram.



$m\overline{AP} = -\frac{11}{3}$

$m\overline{RT} = -\frac{11}{3}$ ∥

$m\overline{AR} = \frac{2}{3}$

$m\overline{PT} = \frac{2}{3}$ ∥

Quad. PART is a parallelogram b/c opp sides are ∥.

△PAT is isos. b/c + has 2 ≅ sides

$PA = \sqrt{(-1 - -4)^2 + (-6-5)^2} = \sqrt{130}$

$AT = \sqrt{(-4-5)^2 + (5 - -2)^2} = \sqrt{130}$ ≅

G.GPE.B.7: POLYGONS IN THE COORDINATE PLANE

101 The endpoints of one side of a regular pentagon are $(-1,4)$ and $(2,3)$. What is the perimeter of the pentagon?

5

1) $\sqrt{10}$
2) $5\sqrt{10}$
3) $5\sqrt{2}$
4) $25\sqrt{2}$

$d = \sqrt{(-1-2)^2 + (4-3)^2}$

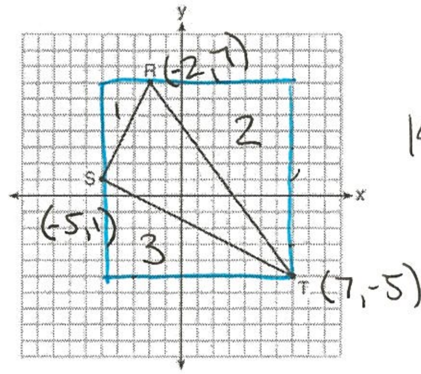
$= \sqrt{(-3)^2 + (1)^2}$

$= \sqrt{9+1}$

$= \sqrt{10}$

$5 \times \sqrt{10} = 5\sqrt{10}$

102 Triangle RST is graphed on the set of axes below.



144 − 99
= 45

How many square units are in the area of $\triangle RST$?

1) $9\sqrt{3} + 15$
2) $9\sqrt{5} + 15$
3) 45
4) 90

$A\triangle 1 = \frac{1}{2}(3)(6) = 9$

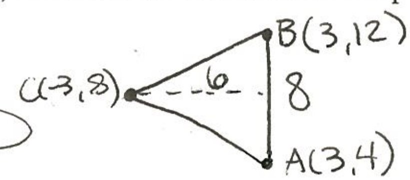
$A\triangle 2 = \frac{1}{2}(9)(12) = 54$ } 99

$A\triangle 3 = \frac{1}{2}(6)(12) = 36$

$A_{rec} = (12)(12) = 144$

103 The coordinates of vertices A and B of $\triangle ABC$ are $A(3,4)$ and $B(3,12)$. If the area of $\triangle ABC$ is 24 square units, what could be the coordinates of point C?

1) (3,6)
2) (8,−3)
3) (−3,8)
4) (6,3)



$\frac{1}{2}(8)b = 24$

$b = 6$

104 The vertices of square $RSTV$ have coordinates $R(-1,5)$, $S(-3,1)$, $T(-7,3)$, and $V(-5,7)$. What is the perimeter of $RSTV$?

1) $\sqrt{20}$
2) $\sqrt{40}$
3) $4\sqrt{20}$
4) $4\sqrt{40}$

$RS = \sqrt{(-1+3)^2 + (5-1)^2}$

$= \sqrt{2^2 + 4^2}$

$= \sqrt{4+16}$

$= \sqrt{20}$

$4 \times \sqrt{20} = 4\sqrt{20}$

17

Formulas

Slope

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Keywords:
- Parallel
- Perpendicular
- Altitude

Distance

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

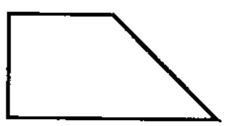
Keywords:
- Congruent
- Length
- Isosceles

Midpoint

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

Keywords:
- Median
- Bisect
- Point of intersection of diagonals
- Center of a circle

- Parallel lines have EQUAL slopes.
- Perpendicular lines have NEGATIVE RECIPROCAL slopes.
- Congruent segments have EQUAL distances.
- Segments that bisect each other have the SAME midpoints.



Trapezoid
- 2 slopes

___ is a trapezoid because it has one pair of parallel sides.

Parallelogram
- 4 slopes

___ is a parallelogram because it has 2 pairs of parallel sides.

Isosceles Trapezoid
- 2 slopes, 2 distance

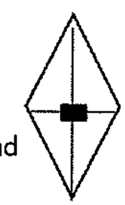
___ is an isosceles trapezoid because it has 1 pair of || sides and non-|| sides are congruent.

Rectangle
- 4 slopes

___ is a rectangle because it has 2 pairs of || sides & a right angle.

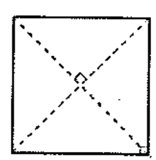
Rhombus
- 6 slopes

___ is a rhombus because it has 2 pairs of || sides and ⊥ diagonals.



Square
- 6 slopes

___ is a square because it has 2 pairs of || sides, ⊥ diagonals and a right angle.



Isosceles Triangle
- 2 distances

___ is an isosceles triangle because it has 2 ≅ sides

Right Triangle
- 2 slopes

___ is a right triangle because it has a right angle.

Isosceles Right Triangle
- 2 slopes
- 2 distances

___ is an isosceles right triangle because it has 2 congruent sides and a right angle.