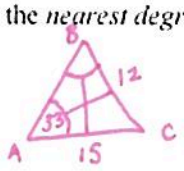
1. In ΔABC, $m\angle A = 33$, $a = 12$, and $b = 15$. What is $m\angle B$ to the *nearest degree*?

1) 41
2) 43
3) 44
4) 48



$\frac{12}{\sin(33)} = \frac{15}{\sin(B)}$

$\frac{15\sin(33)}{12} = \frac{12\sin(B)}{12}$

$\sin^{-1}\left(\frac{15\sin(33)}{12}\right) = B$

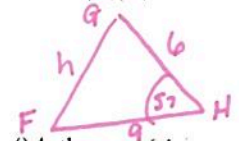
$43 = B$

2. In ΔABC, the complement of $\angle B$ is $\angle A$. Which statement is always true?

1) $\tan\angle A = \tan\angle B$
2) $\sin\angle A = \sin\angle B$
3) $\cos\angle A = \tan\angle B$
4) $\sin\angle A = \cos\angle B$

3. In ΔFGH, $f = 6$, $g = 9$, and $m\angle H = 57$. Which statement can be used to determine the numerical value of h?

1) $h^2 = 6^2 + 9^2 - 2(9)(h)\cos 57°$
2) $h^2 = 6^2 + 9^2 - 2(6)(9)\cos 57°$
3) $6^2 = 9^2 + h^2 - 2(9)(h)\cos 57°$
4) $9^2 = 6^2 + h^2 - 2(6)(h)\cos 57°$



4. If $\sin 6A = \cos 9A$, then $m\angle A$ is equal to

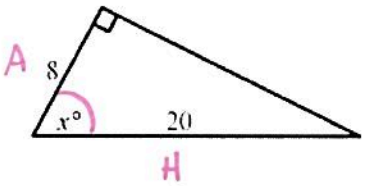
1) 6
2) 36
3) 45
4) $1\frac{1}{2}$

$6A + 9A = 90$

$15A = 90$

$A = 6$

5. Solve for x to the nearest degree.



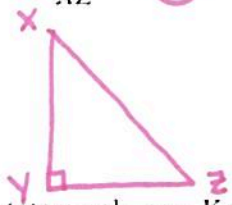
$\cos(x) = \frac{8}{20}$

$\cos^{-1}\left(\frac{8}{20}\right) = x$

[A] 22 [B] 68 [C] 24 [D] 66

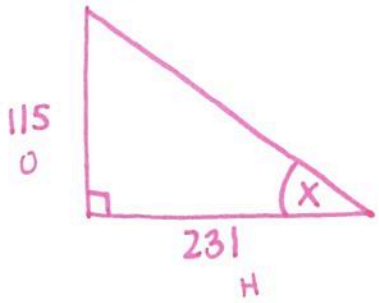
6. ΔXYZ is a right triangle with a right angle at Y. Which of the following is true?

[A] $\cos Z = \frac{XY}{XZ}$ [B] $\sin X = \frac{YZ}{XZ}$ [C] $\sin X = \frac{XY}{XZ}$ [D] $\tan X = \frac{XY}{ZY}$ [E] $\sin Z = \frac{YZ}{XZ}$



7. A large totem pole near Kalama, Washington, is 115 ft tall. On a particular day at noon it casts a 231 ft shadow. What is the sun's angle of elevation at that time?

[A] 29.9° [B] 63.5° [C] 60.1° [D] 26.5°

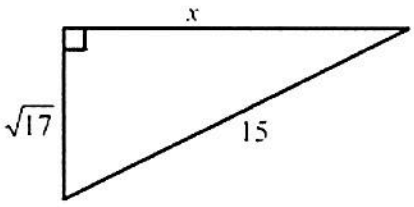


$\sin(X) = \frac{115}{231}$

$\sin^{-1}\left(\frac{115}{231}\right) = X$

$29.85 = X$

8. Use the Pythagorean theorem to solve for x.



[A] $\sqrt{514}$ [B] $\sqrt{208}$
[C] $\sqrt{17}$ [D] $\sqrt{64}$

$x^2 + (\sqrt{17})^2 = 15^2$

$x^2 + 17 = 225$

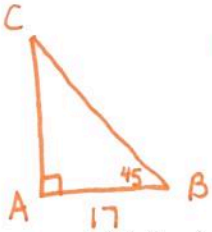
$-17 \quad -17$

$\sqrt{x^2} = \sqrt{208}$

9. In ΔABC, $\angle A$ is a right angle and $m\angle B = 45$. If $AB = 17$ feet, find AC.

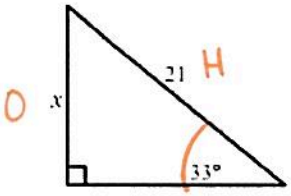
[A] 14.722 ft [B] 29.445 ft

[C] 17 ft [D] 24.042 ft



45-45-90 △

10. What is x to the nearest hundredth?



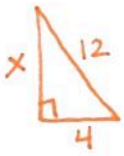
$\frac{\sin(33)}{1} = \frac{x}{21}$

$x = 21\sin(33)$

[A] $x = 11.44$ [B] $x = 13.64$

[C] $x = 17.61$ [D] $x = 32.34$

11. A 12-foot ladder is leaning against a building. The bottom of the ladder is 4 feet from the building. How far up the building is the top of the ladder? Round your answer to the nearest tenth.



$x^2+4^2 = 12^2$

$x^2+16 = 144$

$\sqrt{x^2} = \sqrt{128}$

$x = 11.3$

12. Which set of side lengths cannot form a right triangle?

[A] 12 mm, 16 mm, 20 mm $12^2+16^2=20^2$ ✓

[B] 24 mm, 32 mm, 40 mm $24^2+32^2=40^2$ ✓

[C] 6 mm, 8 mm, 10 mm triple

[D] 13 mm, 16 mm, 20 mm

$425 \neq 400$

13. A slide 3.5 m long makes an angle of 28° with the ground. How high is the top of the slide above the ground?

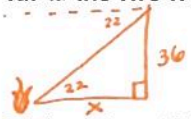
[A] 1.86 m [B] 1.64 m

[C] 3.09 m [D] 1.71 m

$\frac{\sin(28)}{1} = \frac{x}{3.5}$

$x = 3.5\sin(28)$

14. A lookout spots a fire from a 36 meter tower. The angle of depression from the tower to the fire is 22 degrees. To the nearest meter, how far is the fire from the base of the tower?

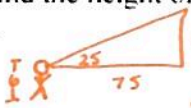


$\frac{\tan(22)}{1} = \frac{36}{x}$

$\frac{36}{\tan(22)} = \frac{x\tan(22)}{\tan(22)}$

$x = 89$

15. A man 6 ft tall walks 75 ft from the base of a tree. He uses a protractor to measure the angle from his eye to the top of the tree. He finds it to be about 25°. Find the height of the tree to the nearest foot.



$\frac{\tan(25)}{1} = \frac{x}{75}$

$x = 75\tan(25)$

$x = 34.97307436$

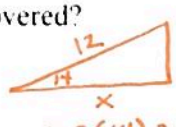
$+6$

41.97

16. Liola drives 12 km up a hill that is at a grade of 14°. What horizontal distance, to the nearest tenth of kilometer, has she covered?

[A] 13.7 km [B] 2.9 km

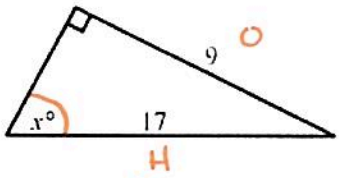
[C] 3 km [D] 11.6 km



$\frac{\cos(14)}{1} = \frac{x}{12}$

$x = 12\cos(14)$

17. Solve for x to the nearest degree.



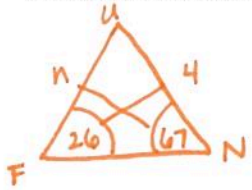
[A] 58 [B] 32 [C] 62 [D] 28

$\sin(x) = \frac{9}{17}$

$\sin^{-1}\left(\frac{9}{17}\right) = x$

$x = 31.96$

18. In ΔFUN, $f = 4$, $m\angle F = 26$, and $m\angle N = 67$. Find the value of n to the *nearest integer*.



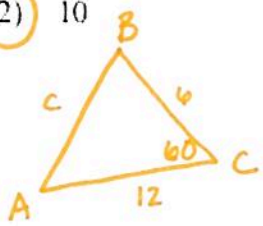
$\frac{n}{\sin(67)} = \frac{4}{\sin(26)}$

$\frac{4\sin(67)}{\sin(26)} = \frac{n\sin(26)}{\sin(26)}$

$n = 8$

19. In ΔABC, $a = 6$, $b = 12$, and $m\angle C = 60$. What is the length of side c to the *nearest integer*?

1) 5
2) 10
3) 11
4) 20

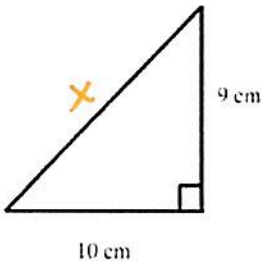


$c^2 = 6^2 + 12^2 - 2(6)(12)\cos(60)$

$\sqrt{c^2} = \sqrt{108}$

$c = 10.4$

20. Given the right triangle below, what is the length of the hypotenuse? Round your answer to the nearest tenth.



[A] 181.0 cm
[B] 13.5 cm
[C] 4.4 cm
[D] 19.0 cm

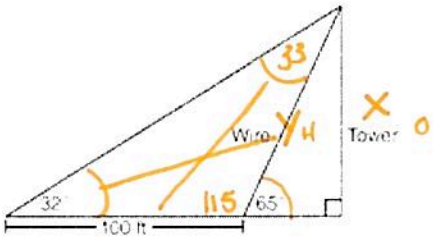
$9^2 + 10^2 = x^2$

$81 + 100 = x^2$

$\sqrt{181} = \sqrt{x^2}$

$x = 13.5$

21. The diagram below shows the plans for a cell phone tower. A guy wire attached to the top of the tower makes an angle of 65 degrees with the ground. From a point on the ground 100 feet from the end of the guy wire, the angle of elevation to the top of the tower is 32 degrees. Find the height of the tower, to the *nearest foot*.



$\frac{Y}{\sin(32)} = \frac{100}{\sin(33)}$

$\frac{100\sin(32)}{\sin(33)} = \frac{Y\sin(33)}{\sin(33)}$

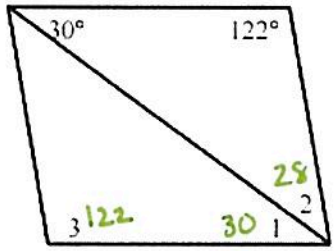
$Y = 97.29733459$

$\frac{\sin(65)}{1} = \frac{x}{97.29733459}$

$x = 97.29733459 \sin(65)$

$x = 88 ft$

22. Find the measures of the numbered angles in the parallelogram.



180 − (122 + 30)

[A] $m\angle 1 = 28;\ m\angle 2 = 30;\ m\angle 3 = 122$

[B] $m\angle 1 = 30;\ m\angle 2 = 28;\ m\angle 3 = 122$

[C] $m\angle 1 = 15;\ m\angle 2 = 61;\ m\angle 3 = 150$

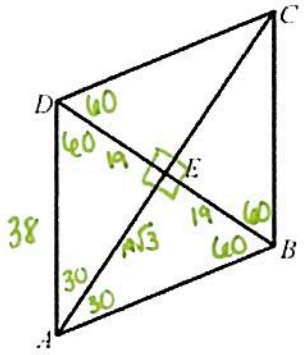
[D] $m\angle 1 = 30;\ m\angle 2 = 15;\ m\angle 3 = 150$

23. In isosceles trapezoid $JKLM$, leg $JK = 7x - 9$, base $KL = 5x + 3$, and leg $LM = 2x + 2$. Find the value of x.

[A] 6 [B] $\frac{11}{5}$ [C] $-\frac{1}{3}$ [D] $-\frac{7}{5}$

$7x - 9 = 2x + 2$
$5x = 11$
$x = 11/5$

24. Given $ABCD$ is a rhombus, $m\angle ABC = 120$, and $EB = 19$. Find the length of $\overline{AD}$.



30-60-90 △

[A] 38 [B] 43 [C] 42 [D] 35

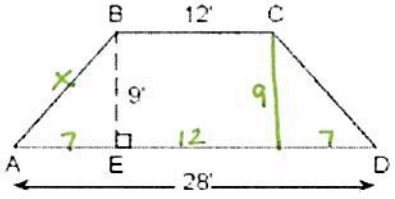
25. The measures of the angles of a quadrilateral are $x + 15$, $2x$, $x - 45$, and $2x - 60$. What type(s) of quadrilateral could this be?
I. parallelogram II. rectangle III. trapezoid

[A] III only [B] I and II [C] II only
[D] I only [E] I and III

$x+15+2x+x-45+2x-60=360$
$6x+90=360$
$\frac{6x}{6}=\frac{450}{6}$ $x=75$

∡s: 90, 150, 35, 90

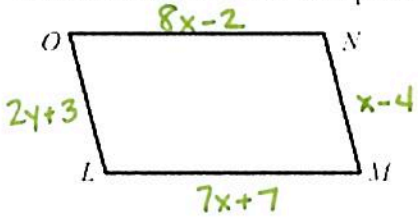
26. The cross section of an attic is in the shape of an isosceles trapezoid, as shown in the accompanying figure. If the height of the attic is 9 feet, $\overline{BC} = 12$ feet, and $AD = 28$ feet, find the length of $\overline{AB}$ to the *nearest foot*.



28 − 12 = 14 ÷ 2 = 7

$7^2 + 9^2 = x^2$
$49 + 81 = x^2$
$\sqrt{130} = \sqrt{x^2}$
$x = 11.4 \rightarrow$ 11 ft

27. If $ON = 8x - 2$, $LM = 7x + 7$, $NM = x - 4$, and $OL = 2y + 3$, find the values of x and y for which $LMNO$ must be a parallelogram.



[A] $x = 9,\ y = 1$ [B] $x = -\frac{1}{5},\ y = -1$

[C] $x = 9,\ y = -1$ [D] $x = 5,\ y = -1$

$8x - 2 = 7x + 7$
$x = 9$

$2y + 3 = x - 4$
$2y + 3 = 9 - 4$
$2y + 3 = 5$
$2y = 2$
$y = 1$

28. A parallelogram must be a rectangle when its
1) diagonals are perpendicular
2) diagonals are congruent
3) opposite sides are parallel
4) opposite sides are congruent

29. Which quadrilateral has diagonals that always bisect its angles and also bisect each other?
1) rhombus
2) rectangle
3) parallelogram
4) isosceles trapezoid

30. A parallelogram is always a rectangle if
1) the diagonals are congruent
2) the diagonals bisect each other
3) the diagonals intersect at right angles
4) the opposite angles are congruent

31. The diagonals of a quadrilateral are congruent but do not bisect each other. This quadrilateral is
1) an isosceles trapezoid
2) a parallelogram
3) a rectangle
4) a rhombus

32. Which reason could be used to prove that a parallelogram is a rhombus?
1) Diagonals are congruent.
2) Opposite sides are parallel.
3) Diagonals are perpendicular.
4) Opposite angles are congruent.

33. Which quadrilateral does *not* always have congruent diagonals?
1) isosceles trapezoid
2) rectangle
3) rhombus
4) square

34. In quadrilateral $ABCD$, each diagonal bisects opposite angles. If $m\angle DAB = 70$, then $ABCD$ must be a
1) rectangle
2) trapezoid
3) rhombus
4) square

bc the ∡ is not 90°

35. In a certain quadrilateral, two opposite sides are parallel, and the other two opposite sides are not congruent. This quadrilateral could be a
1) rhombus
2) parallelogram
3) square
4) trapezoid

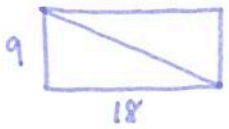
36. Which quadrilateral has diagonals that are always perpendicular bisectors of each other?
1) square
2) rectangle
3) trapezoid
4) parallelogram

37. Which statement is *false*?
1) All parallelograms are quadrilaterals.
2) All rectangles are parallelograms.
3) All squares are rhombuses.
4) All rectangles are squares.

38. Find the measure, to the nearest tenth, of the diagonal of a rectangle with dimensions 18 cm by 9 cm.

[A] 5.2 cm [B] 20.1 cm

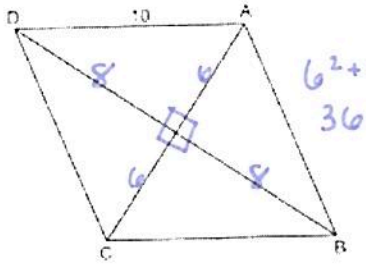
[C] 15.6 cm [D] 19 cm



$9^2 + 18^2 = x^2$

$\sqrt{405} = \sqrt{x^2}$

39. In rhombus $ABCD$, with diagonals $\overline{AC}$ and $\overline{DB}$, $AD = 10$.



$6^2 + x^2 = 10^2$

$36 + x^2 = 100$

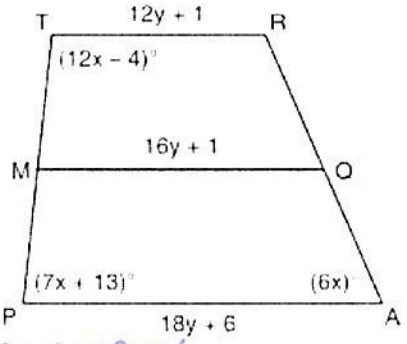
$x^2 = 64$

$x = 8$

If the length of diagonal $\overline{AC}$ is 12, what is the length of $\overline{DB}$?

1) 8 2) 16 3) $\sqrt{44}$ 4) $\sqrt{136}$

40. Trapezoid $TRAP$, with median $\overline{MQ}$, is shown in the diagram below. Solve algebraically for x and y.



$2(16y+1) = 12y+1+18y+6$

$32y + 2 = 30y + 7$

$2y = 5$

$y = 2.5$

$12x - 4 + 7x + 13 = 180$

$19x + 9 = 180$

$19x = 171$

$x = 9$

41. Isosceles trapezoid $ABCD$ has diagonals $\overline{AC}$ and $\overline{BD}$. If $AC = 5x + 13$ and $BD = 11x - 5$, what is the value of x?

1) 28

2) $10\frac{3}{4}$

3) 3

4) $\frac{1}{2}$

$5x + 13 = 11x - 5$

$\frac{18}{6} = \frac{6x}{6}$

$3 = x$

42. In quadrilateral $MNOP$, $\angle M \cong \angle N$. Quadrilateral $MNOP$ could be a I. trapezoid. II. rhombus. III. parallelogram.

[A] I, II, or III [B] II or III

[C] I or II [D] I only [E] III only

43. Select the geometric figure that possesses all of the following characteristics:
(1) quadrilateral
(2) diagonals equal
(3) opposite sides are parallel

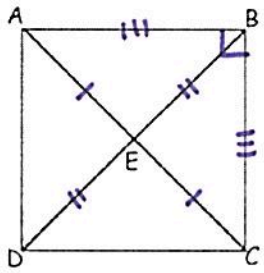
[A] trapezoid [B] parallelogram

[C] rhombus [D] rectangle

44. Given: $AE \cong EC$, $ED \cong EB$

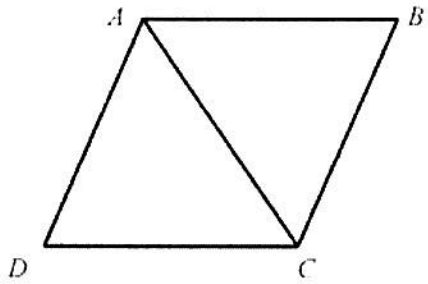
$AB \perp BC$, $AB \cong BC$

Prove: ABCD is a square



S	R
① $AE \cong EC$, $ED \cong EB$ $AB \perp BC$, $AB \cong BC$	① Given
② AC + DB bisect each other	② Bisectors cut segments into $\cong$ segments
③ ABCD is a $\square$	③ If the diagonals of a quad. bisect each other, its a $\square$
④ $\angle B$ is a right $\angle$	④ $\perp$ lines form right $\angle$s
⑤ ABCD is a rectangle	⑤ If a $\square$ has a right $\angle$ its a rectangle
⑥ ABCD is a square	⑥ If a rectangle has $\cong$ adj. sides, its a square

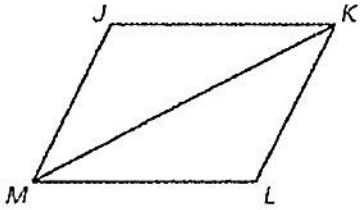
45. Given: $ABCD$ is a rhombus.
Prove: $\Delta BCA \cong \Delta DAC$



S	R
① ABCD is a rhombus	① Given
② $AB \cong DC$, $BC \cong AD$	② In a rhombus, opp. sides are $\cong$
③ $AC \cong AC$	③ Reflexive Property
④ $\Delta BCA \cong \Delta DAC$	④ SSS $\cong$ SSS

46. **Given:** $\Delta MJK \cong \Delta KLM$

Prove: $MJKL$ is a parallelogram.



S	R
① $\Delta MJK \cong \Delta KLM$	① Given
② $JK \cong ML$ $LK \cong JM$	② CPCTC
③ MJKL is a $\square$	③ If both pairs of opp. sides of a quad. are $\cong$, its a $\square$

47. Which equation represents the perpendicular bisector of $\overline{AB}$ whose endpoints are $A(8,2)$ and $B(0,6)$?

1) $y = 2x - 4$
2) $y = -\frac{1}{2}x + 2$
3) $y = -\frac{1}{2}x + 6$
4) $y = 2x - 12$

① $m = \frac{2-6}{8-0} = -\frac{4}{8} = -\frac{1}{2}$

↳ $m_\perp = 2$

② $M = \left(\frac{8+0}{2}, \frac{6+2}{2}\right) = (4,4)$

③ $y = mx + b$

$4 = 2(4) + b$

$4 = 8 + b$

$-4 = b$

$y = 2x - 4$

48. What is an equation of the line that passes through the point $(-2,5)$ and is perpendicular to the line whose equation is $y = \frac{1}{2}x + 5$?

1) $y = 2x + 1$
2) $y = -2x + 1$
3) $y = 2x + 9$
4) $y = -2x - 9$

↳ -2

$y = mx + b$

$5 = -2(-2) + b$

$5 = 4 + b$

$-1 = b$

49. Line ℓ passes through the point $(5,3)$ and is parallel to line k whose equation is $5x + y = 6$. An equation of line ℓ is

1) $y = \frac{1}{5}x + 2$
2) $y = -5x + 28$
3) $y = \frac{1}{5}x - 2$
4) $y = -5x - 28$

$-5x \quad -5x$

$y = -5x + 6$

$m = -5$

$y = mx + b$

$3 = -5(5) + b$

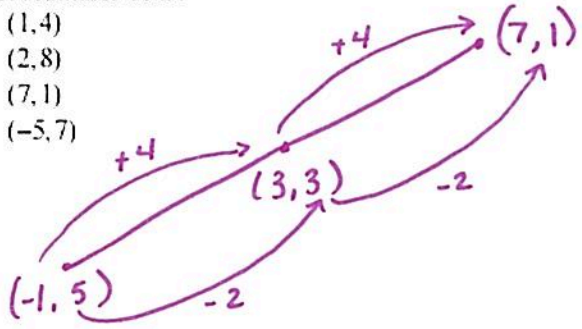
$3 = -25 + b$

$28 = b$

$y = -5x + 28$

50. M is the midpoint of $\overline{AB}$. If the coordinates of A are $(-1,5)$ and the coordinates of M are $(3,3)$, what are the coordinates of B?

1) $(1,4)$
2) $(2,8)$
3) $(7,1)$
4) $(-5,7)$



51. The coordinates of A are $(-9,2)$ and the coordinates of G are $(3,14)$. What are the coordinates of the midpoint of $\overline{AG}$?

1) $(-3,8)$
2) $(-6,6)$
3) $(-6,16)$
4) $(-21,-10)$

$\left(\frac{-9+3}{2}, \frac{2+14}{2}\right)$

$(-3,8)$

52. A line segment has endpoints $(4,7)$ and $(1,11)$. What is the length of the segment?

1) 5
2) 7
3) 16
4) 25

$D = \sqrt{(4-1)^2 + (7-11)^2}$

$D = \sqrt{25}$

$D = 5$

53. Given: Quadrilateral $ABCD$ with $A(-5, 0)$, $B(1, -4)$, $C(5, 2)$, $D(-1, 6)$.
Prove: $ABCD$ is a rectangle.

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

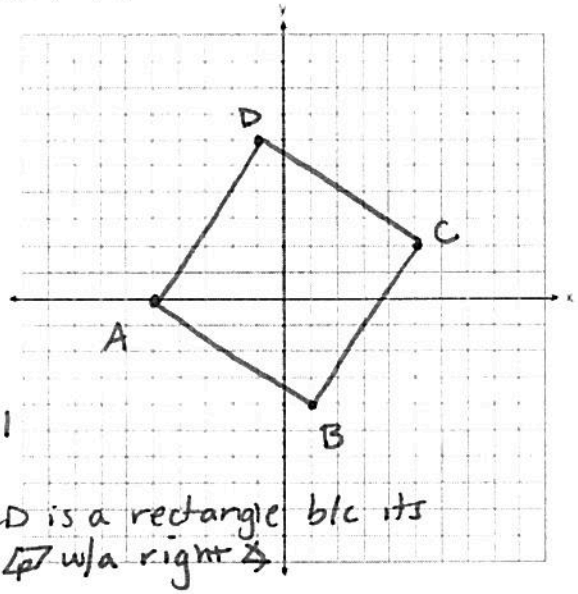
$m_{DC} = \frac{2-6}{5-1} = \frac{-4}{6} = -\frac{2}{3}$

$AB \parallel DC$ b/c they have the same slope

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

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

$AD \parallel BC$ b/c they have the same slope



$ABCD$ is a $\square$ b/c BOTH pairs of opp. sides are $\parallel$

$AB \perp BC$ b/c their slopes are negative reciprocals

$\angle B$ is a right $\angle$ b/c $\perp$ lines form right $\angle$'s

$ABCD$ is a rectangle b/c it's a $\square$ w/ a right $\angle$

54. 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.

$m_{KA} = \frac{7-5}{4-1} = \frac{2}{3}$

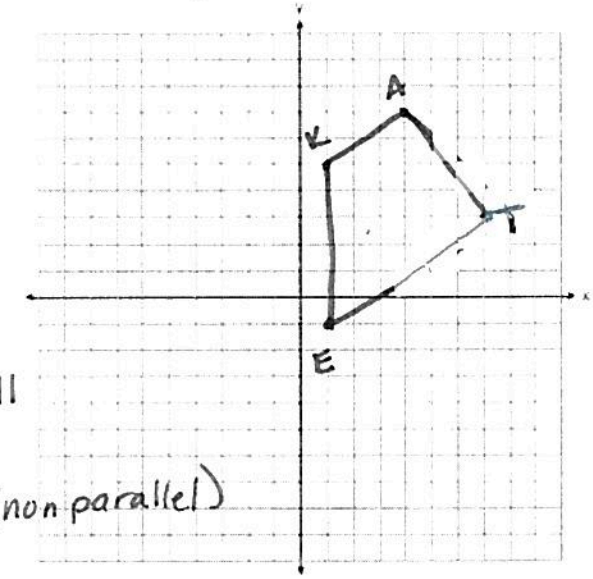
$m_{ET} = \frac{3-(-1)}{7-1} = \frac{4}{6} = \frac{2}{3}$

$KA \parallel ET$ b/c they have the same slope

$m_{KE} = \frac{5-(-1)}{1-1} =$ undefined

$m_{AT} = \frac{7-3}{4-7} = -\frac{4}{3}$

$KE \not\parallel AT$ b/c they have different slopes.



$KATE$ is a trapezoid b/c one pair of sides are $\parallel$

$KE = 6$ $\quad AT = \sqrt{(4-7)^2 + (7-3)^2}$

$AT = 5$

$KE \neq AT$ b/c they are not the same length

$KATE$ is NOT isosceles b/c the legs (non-parallel) are NOT $\cong$

55. 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.]

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

$AB = \sqrt{130}$

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

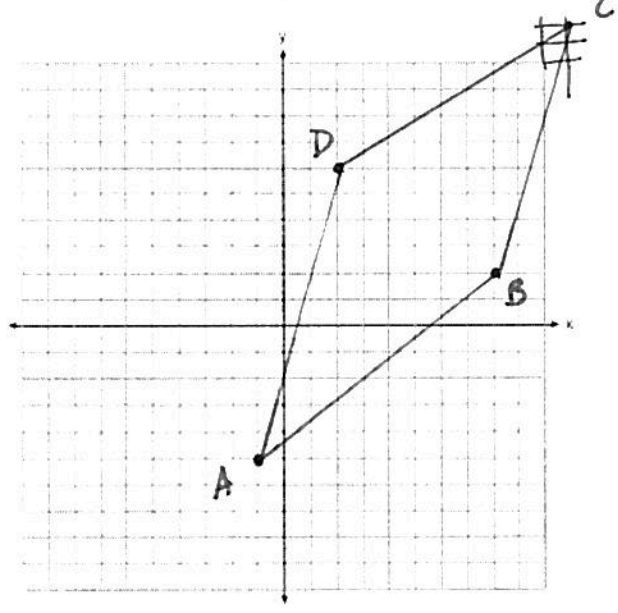
$BC = \sqrt{130}$

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

$CD = \sqrt{130}$

$DA = \sqrt{(2-1)^2 + (6-(-5))^2}$

$DA = \sqrt{130}$



$AB \cong BC \cong CD \cong DA$ b/c they are the same length

$ABCD$ is a rhombus b/c all 4 sides are $\cong$