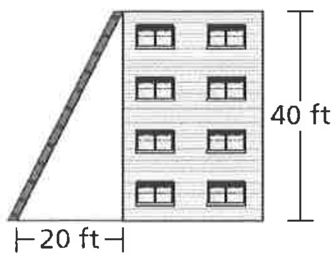
1.3A - Midpoint and Bisect

$\text{slope}(m) = \frac{\text{rise}}{\text{run}}$

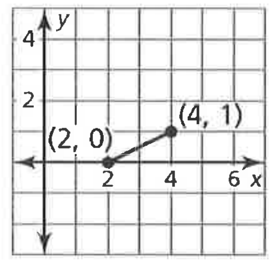
Find the slope.

1.



$m = \frac{40}{20} = \frac{2}{1}$

2.



$m = \frac{1}{2}$

3. (4, −4), (1, 2)

$m = \frac{2-(-4)}{1-4} = \frac{6}{3} = \frac{2}{1}$

4.

+4 +6 +2

x	-5	-1	5	7
y	-3	-1	2	3

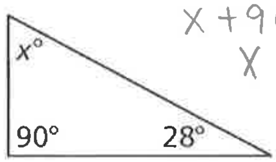
+2 +3 +1

$m = \frac{4}{2} = 2$

Warm Up

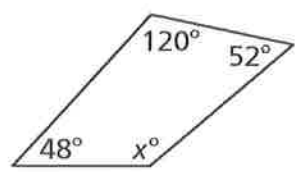
Find the missing angle measure.

1.



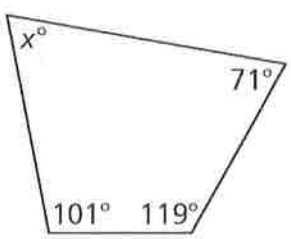
$x + 90 + 28 = 180$
$x + 118 = 180$
$-118 \quad -118$
$\boxed{x = 62°}$

2.

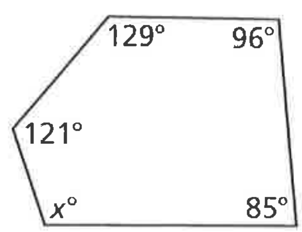


$x + 52 + 48 + 120 = 360$
$x + 220 = 360$
$-220 \quad -220$
$\boxed{x = 140°}$

3.



4.



$x + 71 + 101 + 119 = 360$
$x + 299 = 360$
$-299 \quad -299$
$\boxed{x = 61°}$

$x + 121 + 129 + 96 + 85 = 540$
$x + 431 = 540$
$-431 \quad -431$
$\boxed{x = 109°}$

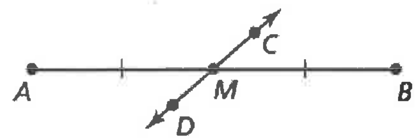
Cumulative Warm Up

Midpoints and Segment Bisectors

The **midpoint** of a segment is the point that divides the segment into two congruent segments.

M is the midpoint of $\overline{AB}$.
So, $\overline{AM} \cong \overline{MB}$ and $AM = MB$.

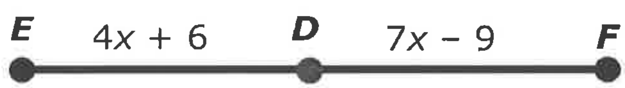
A **segment bisector** is a point, ray, line, line segment, or plane that intersects the segment at its midpoint. A midpoint or a segment bisector *bisects* a segment.



$\overleftrightarrow{CD}$ is a segment bisector of $\overline{AB}$.
So, $\overline{AM} \cong \overline{MB}$ and $AM = MB$.

Core Concept

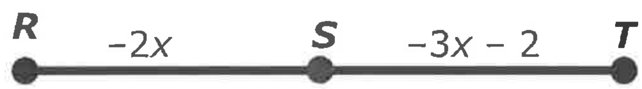
***D* is the midpoint of $\overline{EF}$, *ED* = 4*x* + 6, and *DF* = 7*x* − 9. Find *ED*, *DF*, and *EF*.**



$ED = DF$
$4x+6 = 7x-9$
$-4x \quad -4x$
$6 = 3x-9$
$+9 \quad +9$
$\frac{15}{3} = \frac{3x}{3}$
$5 = x$

$ED = 4(5)+6 = 26$
$DF = 26$
$EF = 52$

***S* is the midpoint of *RT*, *RS* = −2*x*, and *ST* = −3*x* − 2. Find *RS*, *ST*, and *RT*.**

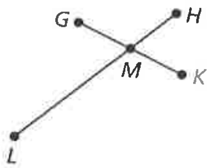


$RS = ST$
$-2x = -3x-2$
$+3x \quad +3x$
$x = -2$

$RS = -2(-2) = 4$
$ST = 4$
$RT = 8$

May 22-1:45 PM

4. *LH* bisects *GK* at *M*. $GM = 2x + 6$, and $GK = 24$. Find *x*.



$2(GM) = 24$

$2(2x+6) = 24$

$4x + 12 = 24$

$-12 \quad -12$

$\frac{4x}{4} = \frac{12}{4}$

$\boxed{x = 3}$

B is the midpoint of AC. AB = 2x+1 and AC = 7x-1. Find the length of AC.

$2(AB) = AC$

$2(2x+1) = 7x-1$

$4x + 2 = 7x - 1$

$-4x \quad -4x$

$2 = 3x - 1$

$+1 \quad +1$

$\frac{3}{3} = \frac{3x}{3}$

$1 = x$

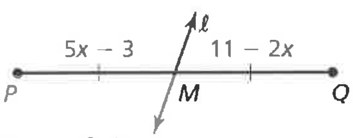
$AC = 7(1) - 1$

$\boxed{AC = 6}$

S is the midpoint of *TV*, $TS = 4x - 7$, and $SV = 5x - 15$. Find *TS*, *SV*, and *TV*.

May 22-1:46 PM

3. Identify the segment bisector of $\overline{PQ}$. Then find *MQ*.



line ℓ bisects $\overline{PQ}$

$PM = MQ$

$5x - 3 = 11 - 2x$

$+2x \quad +2x$

$7x - 3 = 11$

$+3 \quad +3$

$7x = 14$

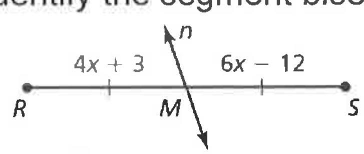
$\frac{7x}{7} = \frac{14}{7}$

$x = 2 \rightarrow MQ = 11 - 2(2)$

$MQ = 11 - 4$

$\rightarrow \boxed{MQ = 7}$

4. Identify the segment bisector of $\overline{RS}$. Then find *RS*.



line n bisects $\overline{RS}$

$RM = MS$

$4x + 3 = 6x - 12$

$-4x \quad -4x$

$3 = 2x - 12$

$+12 \quad +12$

$15 = 2x$

$\frac{15}{2} = \frac{2x}{2}$

$7.5 = x$

$RM = 4(7.5) + 3$

$= 33$

$\boxed{RS = 2(33) = 66}$

Monitoring Progress 3-4

Points A, B, and C are collinear. Point B is between A and C. Find the length indicated.

1) $BC = 2x + 26$, $AB = 2$, and $AC = x + 18$.
Find AC.

$AB + BC = AC$

$2 + 2x + 26 = x + 18$

$2x + 28 = x + 18$
$-x \quad -x$

$x + 28 = 18$

$x + 28 = 18$
$-28 \quad -28$

$x = -10$

$AC = -10 + 18$

$\boxed{AC = 8}$

2) Find BC if $BC = x$, $AB = 11$, and $AC = 3x - 11$.

$AB + BC = AC$

$11 + x = 3x - 11$
$-x \quad -x$

$11 = 2x - 11$
$+11 \quad +11$

$\frac{22}{2} = \frac{2x}{2}$

$11 = x$

$AC = 3(11) - 11$

$AC = 33 - 11$

$\boxed{AC = 22}$

May 22-1:48 PM

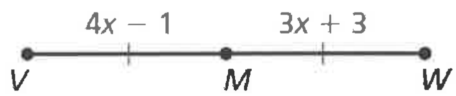
Homework:

WS 1.3A Midpoint and Bisector

May 23-9:29 AM

1.3B - Midpoint in the Coordinate Plane

Point M is the midpoint of $\overline{VW}$. Find the length of $\overline{VM}$.



$VM = MW$

$4x - 1 = 3x + 3$

$-3x \quad -3x$

$x - 1 = 3$

$+1 \quad +1$

$x = 4$

$VM = 4(4) - 1$

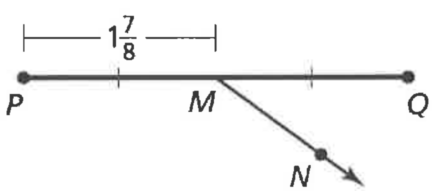
$VM = 16 - 1$

$VM = 15$

May 23-6:46 AM

Identify the segment bisector of $\overline{PQ}$. Then find PQ.

1.



m is the bisector

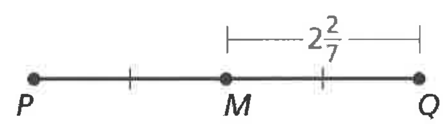
$PQ = 2(PM)$

$= 2\left(1\frac{7}{8}\right)$

$= \cancel{2}\left(\frac{15}{\cancel{8}_4}\right)$

$\boxed{PQ = \frac{15}{4}}$

2.



m is the bisector

$PQ = 2(MQ)$

$= 2\left(2\frac{2}{7}\right)$

$= 2 \cdot \frac{16}{7}$

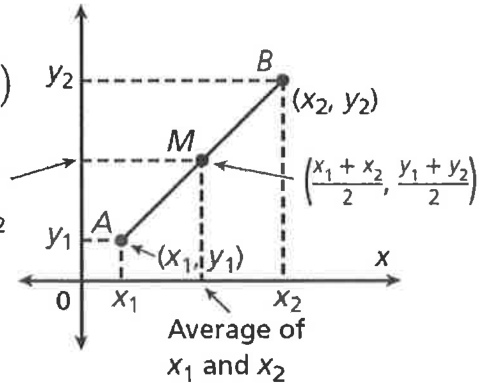
$\boxed{PQ = \frac{32}{7}}$

Monitoring Progress 1-2

Midpoint Formula

The midpoint M of $\overline{AB}$ with endpoints $A(x_1, y_1)$ and $B(x_2, y_2)$ is found by

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right).$$



Core Concept

a. The endpoints of $\overline{RS}$ are $R(1, -3)$ and $S(4, 2)$. Find the coordinates of the midpoint M.

$$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right) \rightarrow \left(\frac{1+4}{2}, \frac{-3+2}{2}\right) \rightarrow \boxed{\left(\frac{5}{2}, \frac{-1}{2}\right)}$$

b. The midpoint of $\overline{JK}$ is $M(2, 1)$. One endpoint is $J(1, 4)$. Find the coordinates of endpoint K.

$$J(1, 4) \xrightarrow[-3]{+1} M(2, 1) \xrightarrow[-3]{+1} K(3, -2)$$

$$\boxed{K(3, -2)}$$

Example 3

5. The endpoints of $\overline{AB}$ are *A*(1, 2) and *B*(7, 8). Find the coordinates of the midpoint *M*.

$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right) \rightarrow \left(\frac{1+7}{2}, \frac{2+8}{2}\right) \rightarrow \left(\frac{8}{2}, \frac{10}{2}\right) \rightarrow \boxed{(4,5)}$

6. The endpoints of $\overline{CD}$ are *C*(−4, 3) and *D*(−6, 5). Find the coordinates of the midpoint *M*.

$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right) \rightarrow \left(\frac{-4+(-6)}{2}, \frac{3+5}{2}\right) \rightarrow \left(\frac{-10}{2}, \frac{8}{2}\right) \rightarrow \boxed{(-5,4)}$

7. The midpoint of $\overline{TU}$ is *M*(2, 4). One endpoint is *T*(1, 1). Find the coordinates of endpoint *U*.

+1 +1

T(1,1) M(2,4) $\boxed{U(3,7)}$

+3 +3

8. The midpoint of *VW* is *M*(−1, −2). One endpoint is *W*(4, 4). Find the coordinates of endpoint *V*.

−5 −5

W(4,4) M(−1,−2) $\boxed{V(-6,-8)}$

−6 −6

Monitoring Progress 5-8

Homework:

WS 1.3B - Midpoint Formula

May 23-8:09 AM

1.3C Pythagorean Theorem and Distance Formula

Bellwork:

1. M is the midpoint of AB. AM = 3x +12. MB = 6x – 3. Find the length of AB.

AM = MB

$3x + 12 = 6x - 3$

$-3x \quad\quad -3x$

$12 = 3x - 3$

$+3 \quad\quad +3$

$\frac{15}{3} = \frac{3x}{3}$

$x = 5$

$AM = 3(5) + 12 = 27$

$AB = 2(AM)$

$AB = 2(27)$

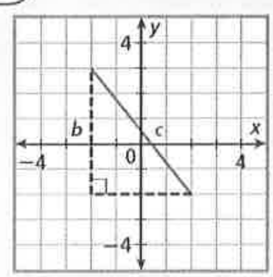
$AB = 54$

May 23-8:03 AM

Theorem 1-6-1 Pythagorean Theorem

In a right triangle, the sum of the squares of the lengths of the *legs* is equal to the square of the length of the *hypotenuse*.

$$a^2 + b^2 = c^2$$



*** c will always be the side **across** from the right angle

*** Length and Distance are the same thing***

** Can do Proof of Pythagorean Theorem Here**

May 23-7:43 AM

exact

Use the Pythagorean Theorem to find the distance, ~~to the nearest tenth~~, from *D*(3, 4) to *E*(−2, −5).

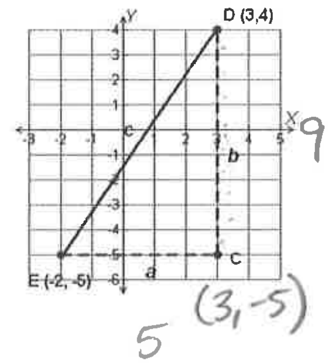
$a^2+b^2=c^2$

$5^2+9^2=c^2$

$25+81=c^2$

$\sqrt{106}=\sqrt{c^2}$

$\sqrt{106}=c$

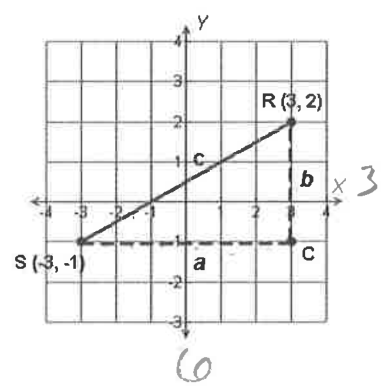


May 23-7:43 AM

exact

Use the Pythagorean Theorem to find the distance, ~~to the nearest tenth,~~ from *R* to *S*.

***R*(3, 2) and *S*(−3, −1)**



$a^2+b^2=c^2$

$3^2+6^2=c^2$

$9+36=c^2$

$\sqrt{45}=\sqrt{c^2}$

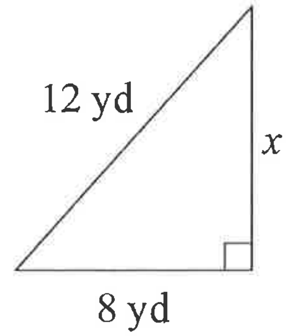
$\sqrt{9}\ \sqrt{5}$

$\sqrt{3}\ \sqrt{3}$

$3\sqrt{5}=c$

May 23-7:44 AM

Find the missing side length of the right triangle. Leave your answer in simplest radical form (exact).



$a^2+b^2=c^2$

$8^2+b^2=12^2$

$64+b^2=144$

$-64 \qquad -64$

$b^2=80$

$\sqrt{b^2}=\sqrt{80}$

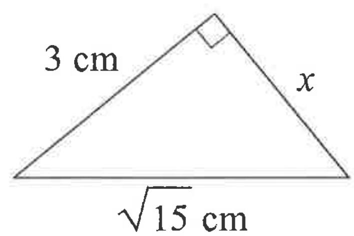
$\sqrt{4}\,\sqrt{20}$

$\sqrt{4}\,\sqrt{5}$

$b=4\sqrt{5}$

Aug 22-4:49 PM

Find the missing side length of the right triangle. Leave your answer in simplest radical form (exact).



$a^2+b^2=c^2$

$3^2+b^2=(\sqrt{15})^2$

$9+b^2=15$

$-9 \qquad -9$

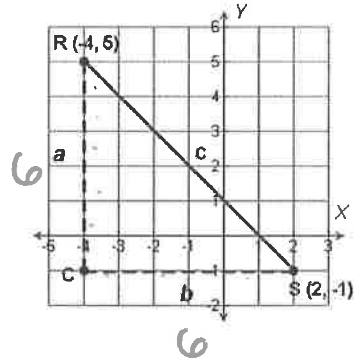
$b^2=6$

$\sqrt{b^2}=\sqrt{6}$

$b=\sqrt{6}$

Aug 22-4:50 PM

Use the Pythagorean Theorem to find the ~~to the nearest tenth~~ exact distance, from *R* to *S*.



***R*(−4, 5) and *S*(2, −1)**

$a^2+b^2=c^2$

$6^2+6^2=c^2$

$36+36=c^2$

$\sqrt{72}=\sqrt{c^2}$

$\sqrt{36}\ \sqrt{2}$

$\sqrt{6}\ \sqrt{6}$

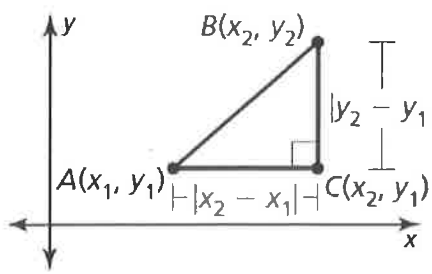
$6\sqrt{2}=c$

May 23-7:45 AM

Distance Formula:

The distance between two points
can be found using the formula:

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



Core Concept

Steps:

1. Label the points
2. Write the formula
3. Plug the points into the formula
4. Simplify

Example

Find the length of GK, given G(5,5) and K(-1,-3)

x_1 y_1

x_2 y_2

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

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

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

$d=\sqrt{36+64}$

$d=\sqrt{100}$

$\boxed{d=10}$

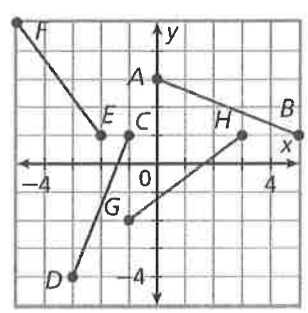
$\boxed{GK=10}$

May 23-7:36 AM

Find *EF* and *GH*. Then determine if $\overline{EF} \cong \overline{GH}$.

x_1 y_1 x_2 y_2 x_1 y_1 x_2 y_2

E(−2, 1), *F*(−5, 5), *G*(−1, −2), *H*(3, 1)



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

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

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

$EF=\sqrt{9+16}$

$EF=\sqrt{25}$

$EF=5$

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

$GH=\sqrt{(4)^2+(3)^2}$

$GH=\sqrt{16+9}$

$GH=\sqrt{25}$

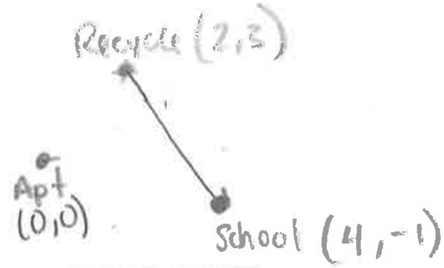
$GH=5$

$EF=GH$

$\overline{EF}\cong\overline{GH}$

May 23-7:39 AM

Your school is 4 miles east and 1 mile south of your apartment. A recycling center, where your class is going on a field trip, is 2 miles east and 3 miles north of your apartment. Estimate the distance between the recycling center and your school.



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

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

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

$d = \sqrt{4 + 16}$

$d = \sqrt{20} = 2\sqrt{5}$ or about 4.5 miles

$\sqrt{4}\ \sqrt{5}$

$\sqrt{2}\ \sqrt{2}$

Example 4

Given the following points, find the distance between them.

1. (-4, 6) and (8, -3)
2. (-1, -1) and (0, 6)
3. (5/3, -7) and (-1/2, 2)
4. (1.5, -3.1) and (9, 4.2)

May 23-8:33 AM

Homework:

WS 1.3C - Pythagorean Theorem and Distance Formula

May 23-8:04 AM