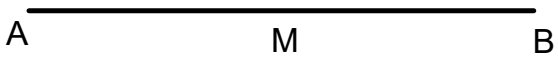
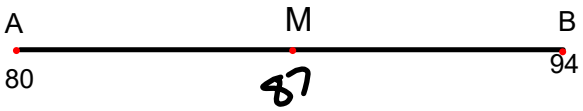
Section 1.3 Locating Points and Midpoints.

The midpoint of a segment is the point halfway between the endpoints of the segments. If M is the midpoint of AB, then AM = MB. To find the midpoint of a segment on a number line, find the mean or average, of the coordinates of its endpoints.



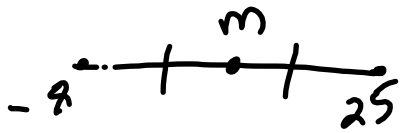
Example: Find the coordinate of M, the midpoint.



87

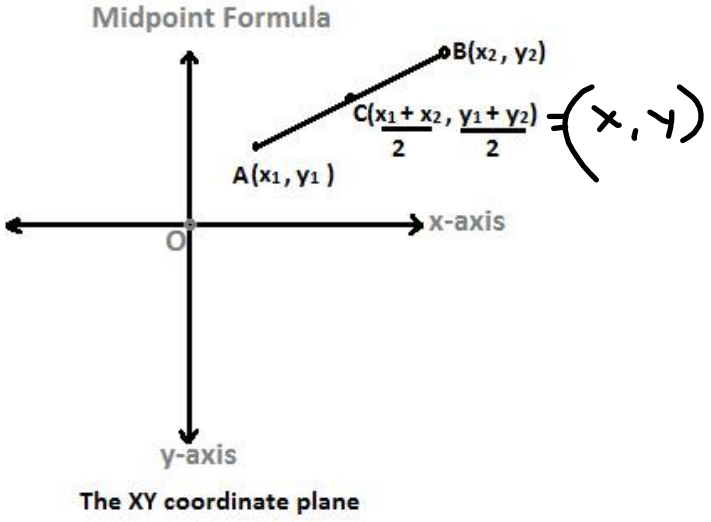
$\frac{80+94}{2} = 87$

Example: the temperature on a thermometer dropped from a reading of 25 to -8 degrees. Find the midpoint of these temperatures.



$\frac{-8+25}{2} = 8.5^{0}$

If a segment is in the coordinate plane, then the x coordinate of the midpoint is the average of the x-coordinates of the endpoints of the segments. Similarly, the y-coordinate of the midpoint is the average of the y-coordinates of the endpoints.



Example: Find the coordinates of M, the midpoint of ST, for S(-6,3) and T(1,0)

$x_1 y_1$

$x_2 y_2$

$$m = \left(\frac{-6+1}{2}, \frac{3+0}{2}\right) = \left(\frac{-5}{2}, \frac{3}{2}\right)$$

Example: Find the coordinates of M, the midpoint of ST, for S(5,12) and T(-4,8)

$x_1 y_1$

$x_2 y_2$

$$\left(\frac{5-4}{2}, \frac{12+8}{2}\right) \therefore m = \left(\frac{1}{2}, 10\right)$$

Example: Find the coordinates of M, the midpoint of ST, for S(-8,-2) and T(5,1)

$$m = \left(\frac{-3}{2}, \frac{-1}{2}\right)$$

x y

Find the *endpoint* B of AB if the *midpoint* is M(3,4) and one endpoint A(-3,-2).

x_1, y_1

$X = \frac{x_2 + x_1}{2}$ $Y = \frac{y_2 + y_1}{2}$

$2 \cdot 3 = \frac{x_2 + -3}{2} \cdot 2$ $2 \cdot 4 = \frac{y_2 + -2}{2} \cdot 2$

$6 = x_2 + -3$ $8 = y_2 + -2$

$+3 \quad +3$ $+2 \quad +2$

$9 = x_2$ $y_2 = 10$

$B = (9, 10)$

x, y

Find the *endpoint* B of AB if the *midpoint* is M(4,-6) and one endpoint A(2,-3).

x_1, y_1

x y

$2 \cdot 4 = \frac{x_2 + 2}{2} \cdot 2$ $2 \cdot -6 = \frac{y_2 + -3}{2} \cdot 2$

$8 = x_2 + 2$ $-12 = y_2 + -3$

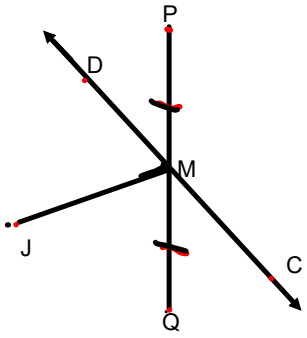
$-2 \quad -2$ $+3 \quad +3$

$x_2 = 6$ $y_2 = -9$

$B(+6, -9)$

Any segment, line or plane that intersects a segment at its midpoint is called a segment bisector.

If M is the midpoint of PQ, then $\overline{JM}$ and $\overleftrightarrow{CD}$ are segment bisectors.



Example: Find the measure of PQ if Q is the midpoint of PR.

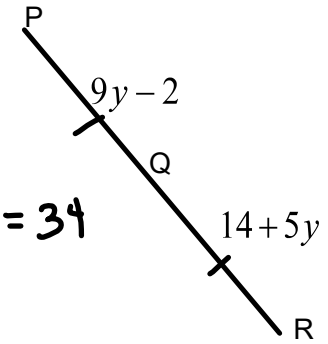
$9y-2=14+5y$

$4y-2=14$

$4y=16$

$y=4$

$PQ = 9(4)-2 = 34$



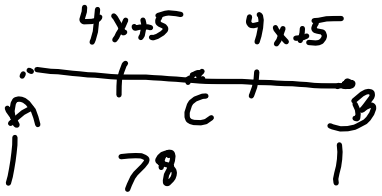
Example: Find the value of x if C is the midpoint of AB, AC=4x+5, and AB=78.

$8x+10=78$

$8x=68$

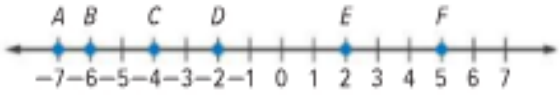
$x=\frac{68}{8}$

$\frac{34}{4}=\frac{17}{2}$



Example Locating a point at Fractional Distances

Find X on AF that is 1/6 of the distance from A to F.



Find the distance between A and F.

$AF = |-7-5| = 12$

$\frac{1}{6} \cdot 12 = \frac{12}{6} = 2$

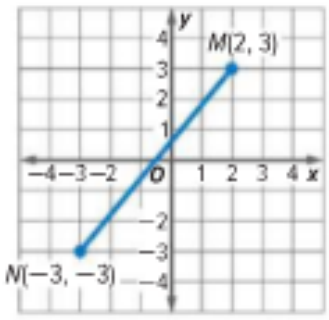
X is 2 units away from A

$A = -7 + 2 = X = -5$

Use the number line above to find the point on CE that is 1/8 of the distance from C to E

Example:

Find R on NM that is 1/4 the distance from N to M.

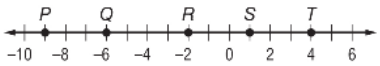


NAME _____ DATE _____ PERIOD _____

1-3 Practice

Locating Points and Midpoints

Use the number line to find the coordinate of the midpoint of each segment.



1. $\overline{RT}$

2. $\overline{QR}$

3. $\overline{ST}$

4. $\overline{PR}$

Find the coordinates of the midpoint of a segment with the given endpoints.

5. $K(-9, 3)$, $H(5, 7)$

6. $W(-12, -7)$, $T(-8, -4)$

Find the coordinates of the missing endpoint if E is the midpoint of $\overline{DF}$.

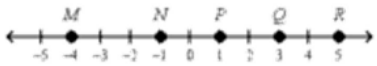
7. $F(5, 8)$, $E(4, 3)$

8. $F(2, 9)$, $E(-1, 6)$

9. $D(-3, -8)$, $E(1, -2)$

Refer to the number line.

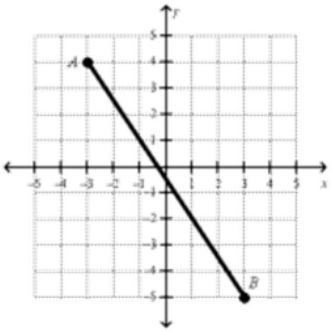
10. Find the point X on $\overline{MR}$ that is $\frac{1}{3}$ of the distance from M to R.



11. Find the point Y on $\overline{NR}$ that is $\frac{2}{3}$ of the distance from N to R.

Refer to the coordinate grid.

12. Find the point X on $\overline{AB}$ that is $\frac{2}{3}$ of the distance from A to B.



13. Find the point Y on $\overline{AB}$ such that the ratio of AY to YB is 1:2.

NAME _____ DATE _____ PERIOD _____

1-3 Skills Practice
Locating Points and Midpoints

Use the number line to find the coordinate of the midpoint of each segment.

1. $\overline{DE}$

2. $\overline{BC}$

3. $\overline{BD}$

4. $\overline{AD}$

Find the coordinates of the midpoint of a segment with the given endpoints.

5. $T(3, 1)$, $U(5, 3)$

6. $J(-4, 2)$, $F(5, -2)$

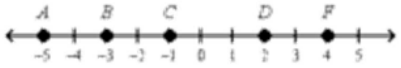
Find the coordinates of the missing endpoint if P is the midpoint of $\overline{NQ}$.

7. $N(2, 0)$, $P(5, 2)$

8. $N(5, 4)$, $P(6, 3)$

9. $Q(3, 9)$, $P(-1, 5)$

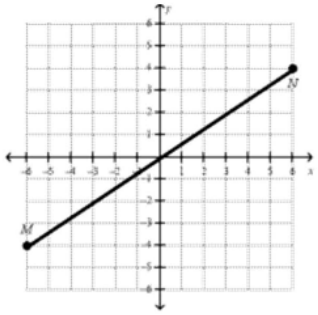
Refer to the number line.



10. Find the point X on $\overline{AF}$ that is $\frac{1}{3}$ of the distance from A to F.

11. Find the point Y on $\overline{AC}$ that is $\frac{1}{4}$ of the distance from A to C.

Refer to the coordinate grid.



12. Find the point X on $\overline{MN}$ that is $\frac{3}{4}$ of the distance from M to N.