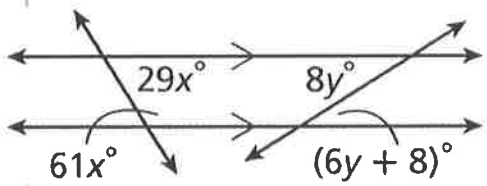
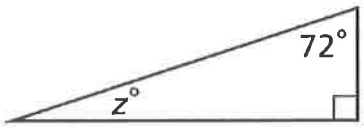
7.2 Properties of Parallelograms

Warm Up
Find the value of each variable.

29x + 61x = 180
90x = 180
x = 2





1. x **2.** y **3.** z

8y = 6y + 8
2y = 8
y = 4

z = 90 − 72
z = 18

Objectives

Prove and apply properties of parallelograms.

Use properties of parallelograms to solve problems.

Parallelogram a quadrilateral with two pairs of parallel sides

Parallelogram $ABCD$
$\square ABCD$

$\overline{AB} \parallel \overline{CD}, \overline{BC} \parallel \overline{DA}$

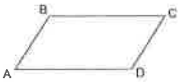
Properties of Parallelograms

If a quadrilateral is a parallelogram, then...

Opposite sides are congruent
(P-Gram Opposite Sides Thm)

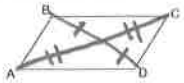
Opposite angles are congruent
(P-Gram Opposite Angles Thm)

Consecutive Angles are Supplementary
(P-Gram Consecutive Angles Thm)

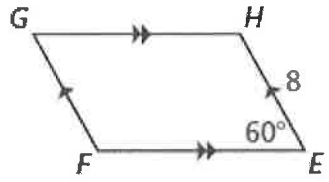


m∠A + m∠B = 180
m∠B + m∠C = 180
m∠C + m∠D = 180
m∠D + m∠A = 180

Diagonals Bisect Each Other
(P-Gram Diagonals Thm)

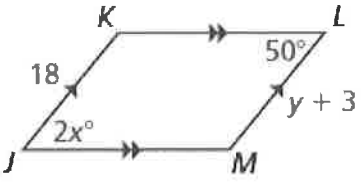


1. Find FG and $m\angle G$.



$FG = 8$ $m\angle G = 60°$

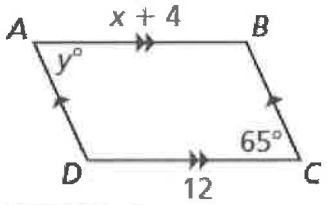
2. Find the values of x and y.



$2x = 50$ $\quad x = 25$

$y + 3 = 18$ $\quad y = 15$

3. Find the values of x and y.



$y = 65°$

$x + 4 = 12$

$x = 8$

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

Find the coordinates of the intersection of the diagonals of $\square LMNO$ with vertices $L(1, 4)$, $M(7, 4)$, $N(6, 0)$, and $O(0, 0)$. * Diagonals bisect each other, so the midpoints will be the same

mdpt of LN: $\left(\frac{1+6}{2}, \frac{4+0}{2}\right) \rightarrow \left(\frac{7}{2}, 2\right)$

mdpt of NO: $\left(\frac{7+0}{2}, \frac{4+0}{2}\right) \rightarrow \left(\frac{7}{2}, 2\right)$

Find the coordinates of the intersection of the diagonals of $\square STUV$ with vertices $S(-2, 3)$, $T(1, 5)$, $U(6, 3)$, and $V(3, 1)$.

mdpt of SU: $\left(\frac{-2+6}{2}, \frac{3+3}{2}\right) \rightarrow (2, 3)$

mdpt of TV: $\left(\frac{1+3}{2}, \frac{5+1}{2}\right) \rightarrow (2, 3)$

Three vertices of $\square ABCD$ are $A(2, 4)$, $B(5, 2)$, and $C(3, -1)$. Find the coordinates of vertex D.

$\overline{AB} \parallel \overline{CD}$

Slope of AB: $\frac{2-4}{5-2} = -\frac{2}{3}$

D: $(0, 1)$ (+3, −2)

C: $(3, -1)$

Check:

slope of AD: $\frac{4-1}{2-0} = \frac{3}{2}$

slope of BC: $\frac{2-(-1)}{5-3} = \frac{3}{2}$

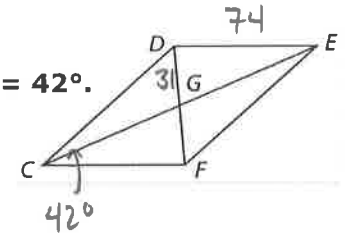
Three vertices of $\square WXYZ$ are $W(-1, -3)$, $X(-3, 2)$, and $Z(4, -4)$. Find the coordinates of vertex Y.

Slope of WX: $\frac{-3-2}{-1-(-3)} = -\frac{5}{2}$

Z: $(4, -4)$ (−2, +5)

Y: $(2, 1)$

In □*CDEF*, *DE* = 74 mm, *DG* = 31 mm, and m∠*FCD* = 42°. Find *CF*.



$CF = DE = \boxed{74 \text{ mm}}$

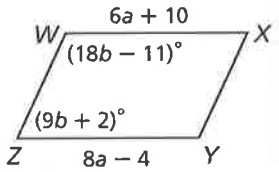
Find m∠*EFC*.

$m\angle EFC = 180 - 42 = \boxed{138°}$

Find *DF*.

$DF = 2(DG) = 2(31) = \boxed{62}$

***WXYZ* is a parallelogram. Find *YZ*.**



$8a - 4 = 6a + 10$
$2a = 14$
$a = 7$

$YZ = 8(7) - 4$
$\boxed{YZ = 52}$

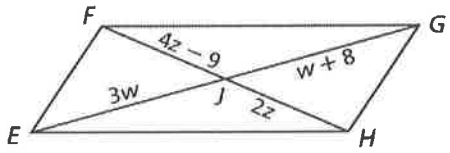
Find m∠*Z*

$9b + 2 + 18b - 11 = 180$
$27b - 9 = 180$
$27b = 189$
$\boxed{b = 7}$

$m\angle Z = 9(7) + 2$
$\boxed{m\angle Z = 65°}$

Find *JG*.

***EFGH* is a parallelogram. Find *JG*.**



$3w = w + 8$
$-w \quad -w$
$2w = 8$
$w = 4$

$JG = 4 + 8 = \boxed{12}$

Find *FH*

$4z - 9 = 2z$
$-9 = -2z$
$4.5 = z$

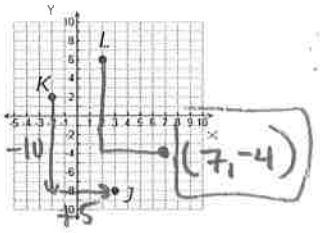
$JH = 2(4.5) = 9$
$FH = 2(9) = \boxed{18}$

Remember!

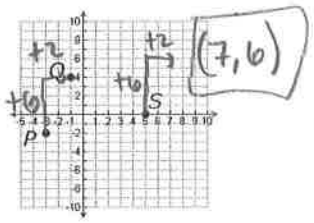
When you are drawing a figure in the coordinate plane, the name *ABCD* gives the order of the vertices.

Three vertices of *JKLM* are *J*(3, −8), *K*(−2, 2), and *L*(2, 6). Find the coordinates of vertex *M*.

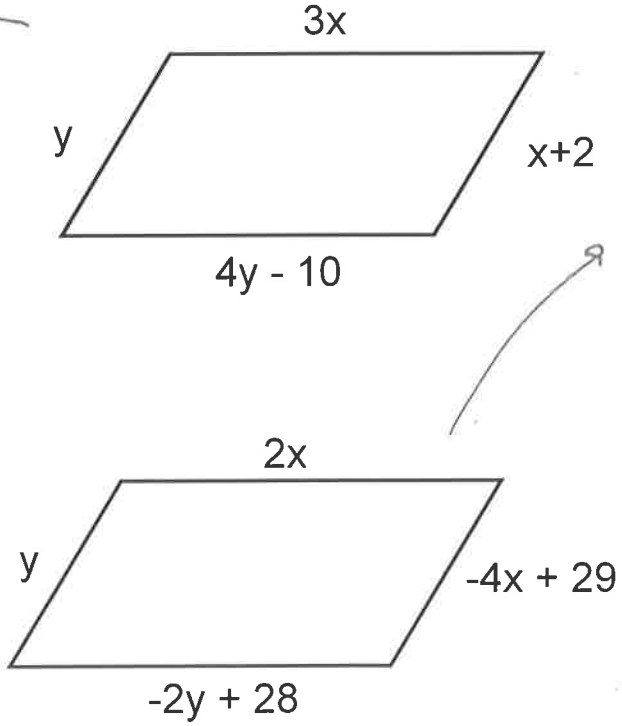
Since *JKLM* is a parallelogram, both pairs of opposite sides must be parallel.



Three vertices of *PQRS* are *P*(−3, −2), *Q*(−1, 4), and *S*(5, 0). Find the coordinates of vertex *R*.



Solve for x and y.



$y = x + 2$

$3x = 4y - 10$

$3x = 4(x+2) - 10$

$3x = 4x + 8 - 10$

$-x = -2$

$x = 2$

$y = (2) + 2$

$y = 4$

$y = -4x + 29$

$2x = -2y + 28$

$2x = -2(-4x + 29) + 28$

$2x = 8x - 58 + 28$

$-6x = -30$

$x = 5$

$y = -4(5) + 29$

$y = 9$

HW: P8 372. # 5-20, 26-28, 31, 32, 39, 40