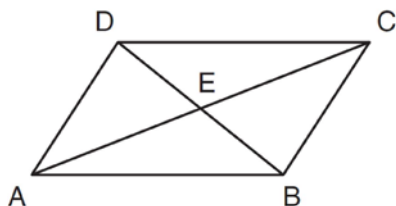


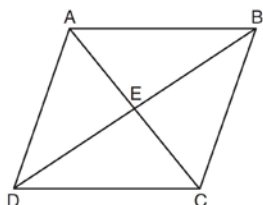
G.G.38: Parallelograms: Investigate, justify, and apply theorems about parallelograms involving their angles, sides, and diagonals

- 1 In the diagram below, parallelogram $ABCD$ has diagonals \overline{AC} and \overline{BD} that intersect at point E .



Which expression is *not* always true?

- 1) $\angle DAE \cong \angle BCE$
 - 2) $\angle DEC \cong \angle BEA$
 - 3) $\overline{AC} \cong \overline{DB}$
 - 4) $\overline{DE} \cong \overline{EB}$
- 2 Parallelogram $ABCD$ with diagonals \overline{AC} and \overline{BD} intersecting at E is shown below.



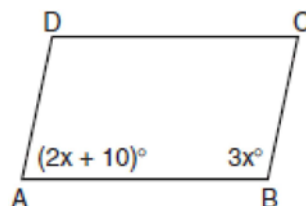
Which statement must be true?

- 1) $\overline{BE} \cong \overline{CE}$
 - 2) $\angle BAE \cong \angle DCE$
 - 3) $\overline{AB} \cong \overline{BC}$
 - 4) $\angle DAE \cong \angle CBE$
- 3 Which statement is *not* always true about a parallelogram?
- 1) The diagonals are congruent.
 - 2) The opposite sides are congruent.
 - 3) The opposite angles are congruent.
 - 4) The opposite sides are parallel.
- 4 Which statement is true about every parallelogram?
- 1) All four sides are congruent.
 - 2) The interior angles are all congruent.
 - 3) Two pairs of opposite sides are congruent.
 - 4) The diagonals are perpendicular to each other.

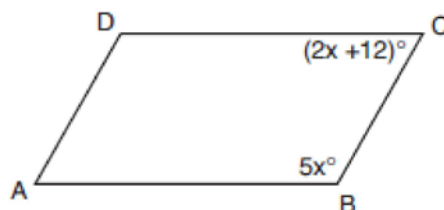
- 5 In parallelogram $QRST$, diagonal \overline{QS} is drawn. Which statement must always be true?

- 1) $\triangle QRS$ is an isosceles triangle.
- 2) $\triangle STQ$ is an acute triangle.
- 3) $\triangle STQ \cong \triangle QRS$
- 4) $\overline{QS} \cong \overline{QT}$

- 6 In the accompanying diagram of parallelogram $ABCD$, $m\angle A = (2x + 10)$ and $m\angle B = 3x$. Find the number of degrees in $m\angle B$.

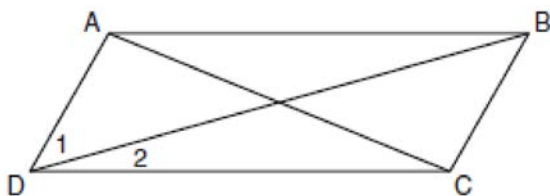


- 7 In the accompanying diagram of parallelogram $ABCD$, $m\angle B = 5x$, and $m\angle C = 2x + 12$. Find the number of degrees in $\angle D$.



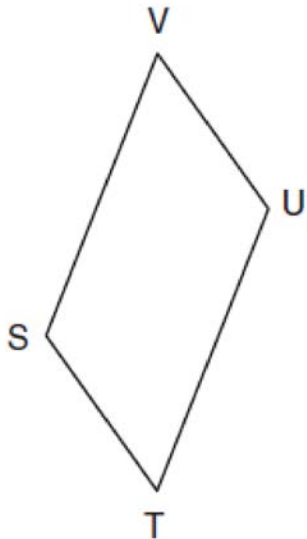
- 8 In parallelogram $JKLM$, $m\angle L$ exceeds $m\angle M$ by 30 degrees. What is the measure of $m\angle J$?
- 1) 75°
 - 2) 105°
 - 3) 165°
 - 4) 195°
- 9 The measures of two consecutive angles of a parallelogram are in the ratio 5:4. What is the measure of an obtuse angle of the parallelogram?
- 1) 20°
 - 2) 80°
 - 3) 100°
 - 4) 160°

- 10 In the diagram below of parallelogram $ABCD$ with diagonals \overline{AC} and \overline{BD} , $m\angle 1 = 45$ and $m\angle DCB = 120$.



What is the measure of $\angle 2$?

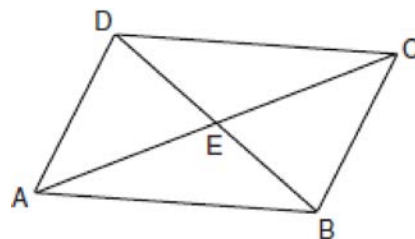
- 1) 15°
 - 2) 30°
 - 3) 45°
 - 4) 60°
- 11 In parallelogram $ABCD$, with diagonal \overline{AC} drawn, $m\angle BCA = 4x + 2$, $m\angle DAC = 6x - 6$, $m\angle BAC = 5y - 1$, and $m\angle DCA = 7y - 15$. Determine $m\angle B$.
- 12 In the diagram below of parallelogram $STUV$, $SV = x + 3$, $VU = 2x - 1$, and $TU = 4x - 3$.



What is the length of \overline{SV} ?

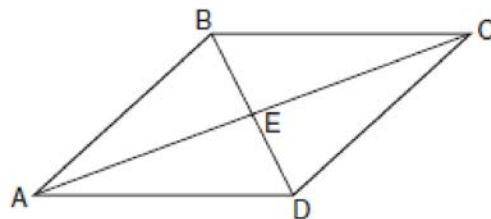
- 1) 5
- 2) 2
- 3) 7
- 4) 4

- 13 In the accompanying diagram of parallelogram $ABCD$, diagonals \overline{AC} and \overline{DB} intersect at E , $AE = 3x - 4$, and $EC = x + 12$.



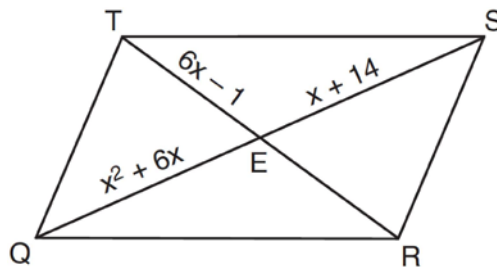
What is the value of x ?

- 1) 8
 - 2) 16
 - 3) 20
 - 4) 40
- 14 In the accompanying diagram of parallelogram $ABCD$, diagonals \overline{AC} and \overline{BD} intersect at E , $BE = \frac{2}{3}x$, and $ED = x - 10$.



What is the value of x ?

- 1) -30
 - 2) 30
 - 3) -6
 - 4) 6
- 15 As shown in the diagram below, the diagonals of parallelogram $QRST$ intersect at E . If $QE = x^2 + 6x$, $SE = x + 14$, and $TE = 6x - 1$, determine TE algebraically.



G.G.38: Parallelograms: Investigate, justify, and apply theorems about parallelograms involving their angles, sides, and diagonals

Answer Section

1 ANS: 3 REF: 061111ge

2 ANS: 2 REF: 011522ge

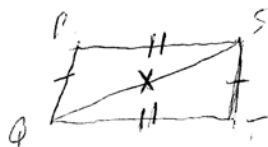
3 ANS: 1

Only rectangles have congruent diagonals.

REF: 060106a

4 ANS: 3 REF: 011104ge

5 ANS: 3



REF: 081402ge

6 ANS:

102. Adjacent angles in a parallelogram are supplementary.
$$\begin{aligned} 2x + 10 + 3x &= 180 \\ x &= 34 \end{aligned} \quad \therefore m\angle B = 3(34) = 102.$$

REF: 060126a

7 ANS:

120. Adjacent angles in a parallelogram are supplementary.
$$\begin{aligned} 2x + 12 + 5x &= 180 \\ x &= 24 \end{aligned} \quad \therefore m\angle B = 5(24) = 120.$$

Opposite angles in a parallelogram are congruent, so $m\angle D = 120$.

REF: 060736a

8 ANS: 2

$$L + L - 30 = 180$$

$$2L = 210$$

$$L = 105$$

REF: 081519ge

9 ANS: 3

Adjacent angles in a parallelogram are supplementary.
$$\frac{5}{5+4} \times 180 = 100.$$

REF: 080618a

10 ANS: 1

$\angle DCB$ and $\angle ADC$ are supplementary adjacent angles of a parallelogram. $180 - 120 = 60$. $\angle 2 = 60 - 45 = 15$.

REF: 080907ge

11 ANS:

$$6x - 6 = 4x + 2 \quad m\angle BCA = 4(4) + 2 = 18 \quad 7y - 15 = 5y - 1 \quad m\angle BAC = 5(7) - 1 = 34 \quad m\angle B = 180 - (18 + 34) = 128$$

$$2x = 8$$

$$2y = 14$$

$$x = 4$$

$$y = 7$$

REF: 061536ge

12 ANS: 1

Opposite sides of a parallelogram are congruent. $4x - 3 = x + 3$. $SV = (2) + 3 = 5$.

$$3x = 6$$

$$x = 2$$

REF: 011013ge

13 ANS: 1

The diagonals of a parallelogram bisect each other.
$$\begin{array}{l} 3x - 4 = x + 12 \\ x = 8 \end{array}$$

REF: 080202a

14 ANS: 2

The diagonals of a parallelogram bisect each other.
$$\begin{array}{l} \frac{2}{3}x = x - 10 \\ x = 30 \end{array}$$

REF: 060626a

15 ANS:

$$11. \quad x^2 + 6x = x + 14. \quad 6(2) - 1 = 11$$

$$x^2 + 5x - 14 = 0$$

$$(x + 7)(x - 2) = 0$$

$$x = 2$$

REF: 081235ge