Determine the converse, inverse, and contrapositive of the conditional statements. Indicate whether each statement is true or false.

1. Conditional statement: If R is the midpoint of $\overline{QS}$, then $\overline{QR} \cong \overline{RS}$.   (T)

    $q \to p$
    Converse: If $\overline{QR} \cong \overline{RS}$, then R is midpoint of $\overline{QS}$. (T)

    $\sim p \to \sim q$
    Inverse: If R is not the midpoint of $\overline{QS}$, then $\overline{QR} \not\cong \overline{RS}$. (T)

    $\sim q \to \sim p$
    Contrapositive: If $\overline{QR} \not\cong \overline{RS}$, then R is not the midpoint. (T)

Write a biconditional from each given conditional and converse.

2. Conditional: If two angles share a side, then they are adjacent. $p \to q$ (T)

    Converse: If two angles are adjacent, then they share a side. $q \to p$ (T)

    Biconditional: Two angles share a side iff they are adjacent.
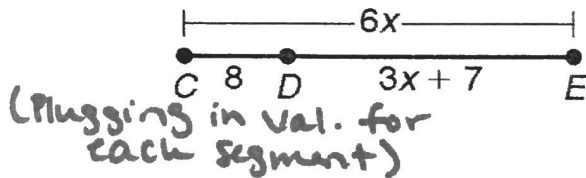
Identify the property that justifies each statement.

3. If $\angle ABC \cong \angle DEF$, then $\angle DEF \cong \angle ABC$.

    Symmetric prop. of Equal.
    (they switched)

4. $\angle 1 \cong \angle 2$ and $\angle 2 \cong \angle 3$, so $\angle 1 \cong \angle 3$.

    Transitive Property
    (They are both $\cong$ to the same $\angle$)

5. $\overline{WX} \cong \overline{XW}$

    Reflexive prop. of Equal
    ($\overline{WX}$ & $\overline{XW}$ are the same segment, so we are stated it $\cong$ to itself.)

Write a justification for each step.

6. $CE = CD + DE$ Segment Add. prop.
    $6x = 8 + (3x + 7)$ Substitution prop (Plugging in val. for
    $6x = 15 + 3x$ Combine like terms   each segment)
    $3x = 15$ Subtraction PoE
    $x = 5$ Division PoE

Diagram: segment of length $6x$ from C to E; C to D = 8, D to E = $3x + 7$.

Write a justification for each step.

7. $m\angle PQR = m\angle PQS + m\angle SQR$ Angle Add. Post.
    $90° = 2x° + (4x - 12)°$ Substitution Prop.
    $90 = 6x - 12$ Combine like terms
    $102 = 6x$ Add. prop. of Eq.
    $17 = x$ Division PoE

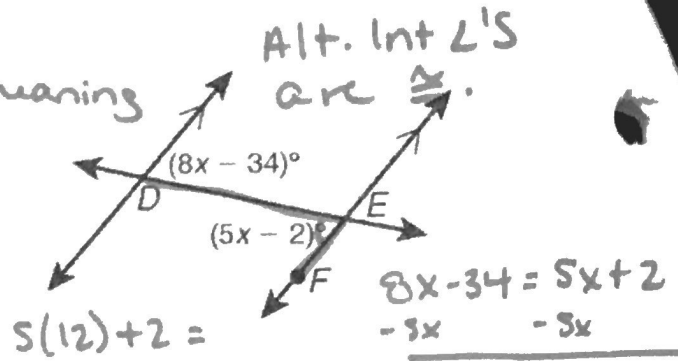Diagram: angle at Q with ray QP vertical, ray QS at $2x°$, ray QR horizontal, angle $(4x - 12)°$.
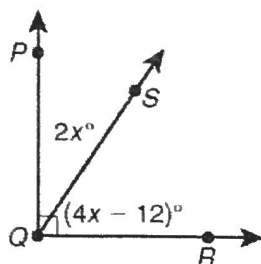
Find each angle measure.

$83 + x = 180$

$x = 97$
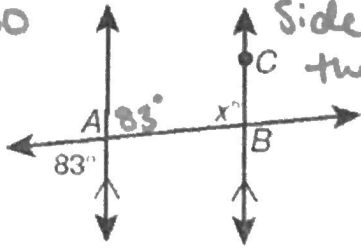
83 & x are same
Side int ∠'s, meaning
they are Supp.

Alt. Int ∠'s are ≅.

$(8x - 34)°$

$(5x - 2)°$

$5(12) + 2 =$

$8x - 34 = 5x + 2$

$-5x \qquad -5x$

$3x - 34 = 2$

$+34 \quad +34$

$3x = 36$

$\boxed{x = 12}$

8. m∠ABC ___97°___

9. m∠DEF ___62°___

Give two examples of each kind of angle pair in the figure.

10. alternate interior angles ___∠3 & ∠5, ∠4 & ∠6___
    (≅)

11. alternate exterior angles ___∠1 & ∠7, ∠2 & ∠8___
    (≅)

12. same-side interior angles ___∠4 & ∠5, ∠3 & ∠6___
    (Supp)

13. Corresponding angles ___∠1 & ∠5, ∠4 & ∠8, ∠2 & ∠6___
    (≅) ___∠3 & ∠7___
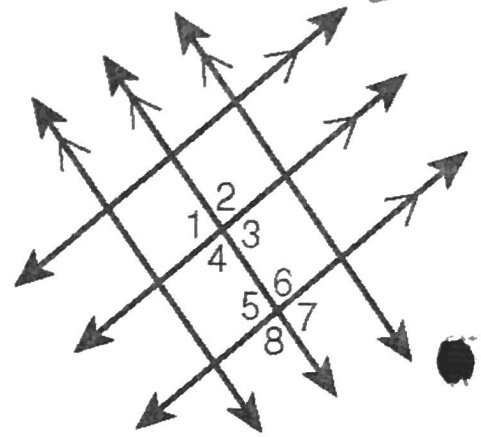
14. **Given** $p \parallel q$ **, m∠1 = 100°, and m∠2 = 61°, find the measures of all the numbered angles.**

* Use the △ to help w/ angles 10, 11, 12

m∠3 = ___80°___, m∠4 = ___80°___, m∠5 = ___100°___, m∠6 = ___119°___

m∠7 = ___61___, m∠8 = ___61°___, m∠9 = ___119°___

m∠10 = ___39°___, m∠11 = ___141°___, m∠12 = ___141°___

What is the relationship between ∠1 and ∠4? Same Side Int ∠'s (Supp)

What is the relationship between ∠2 and ∠8? Alt. Int ∠'s (≅)

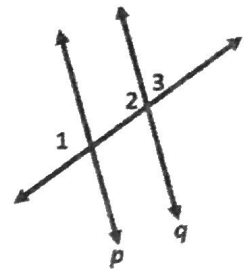What is the relationship between ∠6 and ∠9? Alt. Ext ∠'s (≅)

Complete the two-column proof to show that same-side exterior angles are supplementary.

15. Given: $p \parallel q$

Prove: $m\angle 1 + m\angle 3 = 180°$

Statements	Reasons
1. $p \parallel q$	1. Given
2. a. $m\angle 2 + m\angle 3 = 180°$	2. Lin. Pair Thm.
3. $\angle 1 \cong \angle 2$	3. b. Corresponding $\angle$'s post.
4. c. $m\angle 1 = m\angle 2$	4. Def. of $\cong$ $\angle$s
5. d. $m\angle 1 + m\angle 3 = 180$	5. e. Substitution Prop.

(plugged $m\angle 1$ in for $m\angle 2$)

Use the figure for Exercises 16-19. Tell whether lines m and n must be parallel from the given information. If they are, state your reasoning. (Hint: The angle measures may change for each exercise, and the figure is for reference only.)
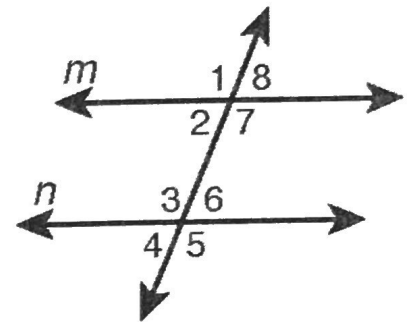
16. $\angle 7 \cong \angle 3$ m//n by:
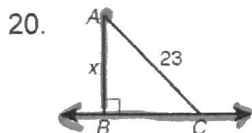
Converse of Alt. int $\angle$'s

18. $\angle 7 \cong \angle 6$ NO!

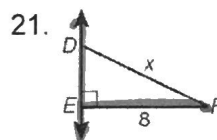$\angle 7$ & $\angle 6$ need to be supp. in order to prove lines are parallel!

17. $m\angle 3 = (15x + 22)°$, $m\angle 1 = (19x - 10)°$, $x = 8$. 142° 142°

m//n by: Converse of corresponding $\angle$s.

19. $m\angle 2 = (5x + 3)°$, $m\angle 3 = (8x - 5)°$, $x = 14$ 73° 107°

m//n by: Converse of same side int $\angle$'s.

Name the shortest segment from the point to the line and write an inequality for x.

20.

21.

$\overline{AB}$; $x < 23$

$\overline{FE}$; $8 < x$ or $x > 8$