

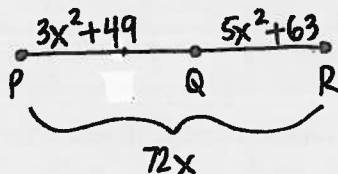
**Part 1: Multiple Choice.** Choose the best answer. Fill in the appropriate letter on your AccuScan.

1. Suppose  $P$ ,  $Q$ , and  $R$  are collinear and  $Q$  is between  $P$  and  $R$ . Solve for the variable if:

$$PQ = 3x^2 + 49$$

$$QR = 5x^2 + 63$$

$$PR = 72x$$



$$3x^2 + 49 + 5x^2 + 63 = 72x$$

$$8x^2 - 72x + 112 = 0$$

$$8(x^2 - 9x + 14) = 0$$

$$8(x-7)(x-2) = 0$$

- (a)  $x = 2$  only      (b)  $x = 7$  or  $x = 2$       (c)  $x = 7$  only      (d) no solution
2. Choose the statement that is the *contrapositive* of the given conditional statement.

Given: If my TV is not broken, then I will watch all the shows of *Shark Week*.

- (a) If my TV is broken, then I will not watch all the shows of *Shark Week*.  
 (b) If I am watching all the shows of *Shark Week*, then my TV is broken.  
 (c) If my TV is not broken, then I will not watch all the shows of *Shark Week*.  
 (d) If I am not watching all the shows of *Shark Week*, then my TV is broken.
3. The conditional statement and its converse are true. Which of the following statements best describes the information?

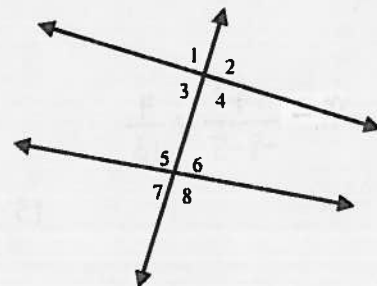
If  $D$  is the midpoint of  $\overline{CE}$ , then  $\overline{CD} \cong \overline{DE}$ .

If  $C$ ,  $D$ , and  $E$  are collinear and  $\overline{CD} \cong \overline{DE}$ , then point  $D$  is the midpoint of  $\overline{CE}$ .

- (a) If  $C$ ,  $D$ , and  $E$  are collinear and  $\overline{CD} \cong \overline{DE}$ , then point  $D$  is the midpoint of  $\overline{CE}$ .  
 (b)  $\overline{CD} \cong \overline{DE}$   
 (c) If  $D$  is the midpoint of  $\overline{CE}$ , then  $\overline{CD} \cong \overline{DE}$ .  
 (d)  $\overline{CD} \cong \overline{DE}$  if and only if point  $D$  is the midpoint of  $\overline{CE}$ .

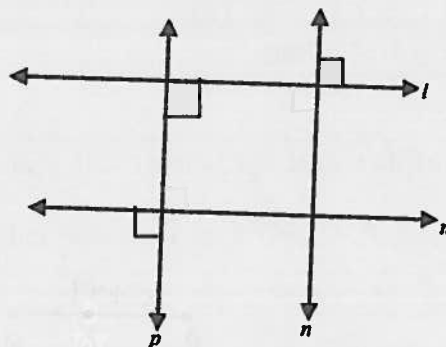
4. Refer to the diagram at right, and state the relationship between  $\angle 4$  and  $\angle 5$ .

- (a) Alternate Exterior Angles  
 (b) Alternate Interior Angles  
 (c) Corresponding Angles  
 (d) Same-Side Interior Angles  
 (e) No relationship



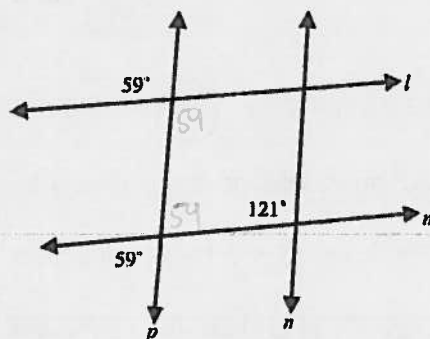
5. Determine which lines, if any, are parallel based on the labeled information in the diagram.

- (a)  $l \parallel m$  only
- (b)  $p \parallel n$  only
- (c)  $l \parallel m$  and  $p \parallel n$
- ~~(d)  $l \parallel n$  and  $p \parallel m$~~
- (e) No lines are parallel



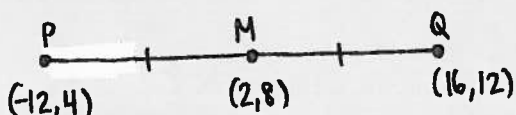
6. Determine which lines, if any, are parallel based on the labeled information in the diagram.

- ~~(a)  $l \parallel n$  and  $p \parallel m$~~
- (b)  $p \parallel n$  and  $l \parallel m$
- (c)  $l \parallel m$  only
- (d)  $p \parallel n$  only
- (e) No lines are parallel



**Part 2: Free Response.** Answer each of the following in pencil in the space provided. Show steps and box final answers where appropriate. Point values are shown. Round final answers to the nearest thousandth or express in exact form (lowest-terms fraction or simplified radical).

7. The midpoint of the line segment whose endpoints are  $(-12, 4)$  and  $(16, 12)$  is  $(2, 8)$ . Use the distance formula to demonstrate that  $(2, 8)$  is the midpoint.



$$\begin{aligned} \overline{PM} &= \sqrt{(8-4)^2 + (2+12)^2} \\ &= \sqrt{212} \end{aligned}$$

$$\begin{aligned} \overline{MQ} &= \sqrt{(12-8)^2 + (16-2)^2} \\ &= \sqrt{212} \end{aligned}$$

$$\overline{PM} \cong \overline{MQ}$$

8. Find the equation of a line in standard form that passes through the points  $(5, -1)$  and  $(-8, 3)$ .

$$(ax+by=c)$$

$$m = \frac{3+1}{-8-5} = \frac{4}{-13}$$

$$y+1 = \frac{-4}{13}(x-5)$$

$$13 \left( y+1 = \frac{-4}{13}x + \frac{20}{13} \right)$$

$$13y + 13 = -4x + 20$$

$$\boxed{4x + 13y = 7}$$

9. Given line  $L$  and point  $P$ . Find a line that is A) PARALLEL to and B) PERPENDICULAR to line  $L$  that passes through point  $P$ .

$x$   $y$   
 $P(-1, 6)$ ;  $L: \frac{5x}{7} - \frac{2y}{3} = \frac{11}{12}$

$$\frac{3}{-2} \left( -\frac{2y}{3} = -\frac{5x}{7} + \frac{11}{12} \right)$$

$$y = \frac{15}{14}x - \frac{33}{24}$$

a) parallel:  $m = \frac{15}{14}$

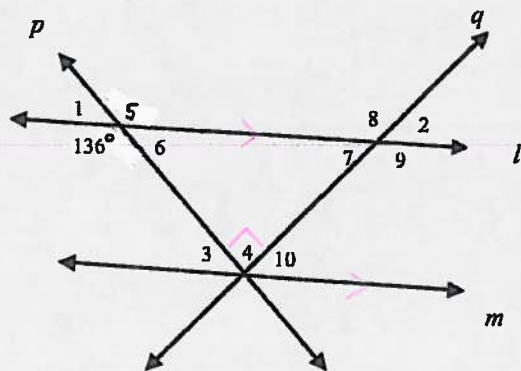
$$y - 6 = \frac{15}{14}(x + 1) \quad \text{or} \quad y = \frac{15}{14}x + \frac{99}{14}$$

b) perpendicular:  $m = -\frac{14}{15}$

$$y - 6 = -\frac{14}{15}(x + 1) \quad \text{or} \quad y = -\frac{14}{15}x + \frac{76}{15}$$

10. Solve for all the missing angle measurements. Justify each answer with a brief explanation.

Given:  $q \perp p$ ,  $l \parallel m$



$m\angle 1 = 44^\circ$ linear pair w/ $136^\circ$ ; def. sup. $\angle$ s	$m\angle 6 = 44^\circ$ vertical $\angle$ s theorem (w/ $\angle 1$ )
$m\angle 2 = 46^\circ$ vertical $\angle$ s theorem (w/ $\angle 7$ )	$m\angle 7 = 46^\circ$ alt. int. $\angle$ s theorem (w/ $\angle 10$ )
$m\angle 3 = 44^\circ$ alt. int. $\angle$ s theorem (w/ $\angle 6$ )	$m\angle 8 = 134^\circ$ linear pair w/ $\angle 2$ or $\angle 7$
$m\angle 4 = 90^\circ$ def. $\perp$ lines; def. rt. $\angle$	$m\angle 9 = 134^\circ$ vertical $\angle$ s theorem (w/ $\angle 8$ )
$m\angle 5 = 136^\circ$ vertical $\angle$ s theorem w/ $136^\circ$	$m\angle 10 = 46^\circ$ def. sup. $\angle$ s (w/ $\angle 3 + \angle 4$ )

11. The graph of  $y = \frac{1}{3}x - 12$  is *parallel* to a line containing the point  $(k, 8)$  and  $(9, -3)$ . Find  $k$ .

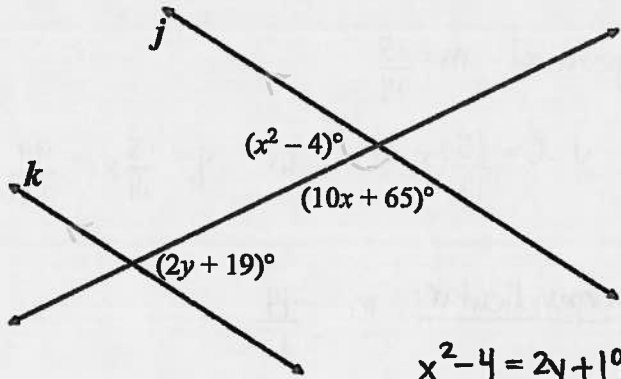
$$m = \frac{1}{3}$$

$$\frac{1}{3} = \frac{-3 - 8}{9 - k} = \frac{-11}{9 - k}$$

$$9 - k = -33$$

$$\boxed{k = 42}$$

12. Solve for all possible values of  $x$  and  $y$ , given that  $j \parallel k$ . Justify your setup with a theorem, postulate, or definition. (Note that the drawing is NOT to scale!)



$$x^2 - 4 + 10x + 65 = 180 \leftarrow \text{linear pair thm.}$$

$$x^2 + 10x - 119 = 0$$

$$(x+17)(x-7) = 0$$

$$\boxed{x = -17, 7}$$

$$x^2 - 4 = 2y + 19 \leftarrow \text{alt. int. } \angle \text{s thm.}$$

$$\text{When } x = -17, \boxed{y = 133}$$

$$\text{When } x = 7, \boxed{y = 13}$$

13. Given that  $\angle 1$  and  $\angle 2$  are complementary,  $m\angle 1 = p^2 + 34$ , and  $m\angle 2 = 7p - 4$ . Find the value of  $p$ .

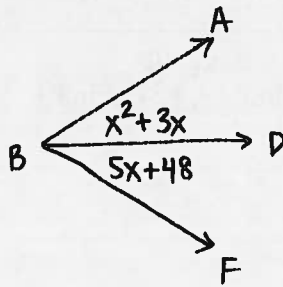
$$p^2 + 34 + 7p - 4 = 90$$

$$p^2 + 7p - 60 = 0$$

$$(p+12)(p-5) = 0$$

$$\boxed{p = -12, 5}$$

14. Given that  $\overline{BD}$  bisects  $\angle ABF$ ,  $m\angle ABD = x^2 + 3x$ , and  $m\angle DBF = 5x + 48$ . Find the values of  $x$ ,  $m\angle ABD$ ,  $m\angle DBF$ , and  $m\angle ABF$ . Draw a diagram to illustrate the situation.



$$x^2 + 3x = 5x + 48$$

$$x^2 - 2x - 48 = 0$$

$$(x-8)(x+6) = 0$$

$$\boxed{x = 8, -6}$$

$$\text{When } x = 8,$$

$$\boxed{m\angle ABD = m\angle DBF = 88^\circ}$$

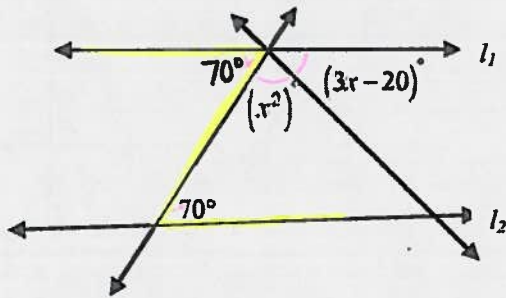
$$\boxed{m\angle ABF = 176^\circ}$$

$$\text{When } x = -6,$$

$$\boxed{m\angle ABD = m\angle DBF = 18^\circ}$$

$$\boxed{m\angle ABF = 36^\circ}$$

15. Find all values of  $x$  that will make  $l_1 \parallel l_2$ . Justify your setup.



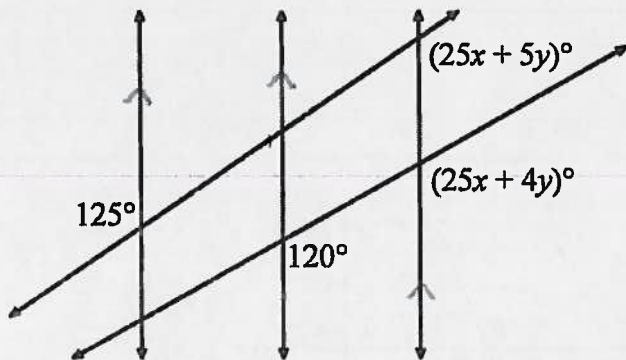
alt. int.  $\angle$ s converse  
 $x^2 + 3x - 20 + 70 = 180$  ← def. supp.  $\angle$ s

$$x^2 + 3x - 130 = 0$$

$$(x+13)(x-10) = 0$$

$$\boxed{x = -13, 10}$$

16. Find the value of  $x$  and  $y$ .



$$25x + 5y = 125 \quad (\text{alt. ext. } \angle\text{s})$$

$$-(25x + 4y = 120) \quad (\text{corresp. } \angle\text{s})$$

$$\boxed{y = 5}$$

$$25x + 5(5) = 125$$

$$25x = 100$$

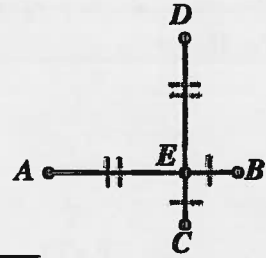
$$\boxed{x = 4}$$

A.M.D.G.

Part 3: Proofs. Write in two-column or paragraph form.

17. Given:  $\overline{BE} \cong \overline{CE}$ ,  $\overline{DE} \cong \overline{AE}$

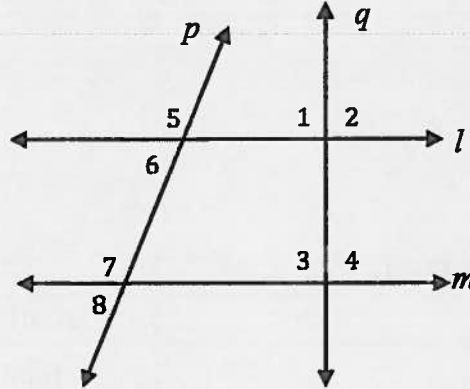
Prove:  $\overline{AB} \cong \overline{CD}$



STATEMENT	REASON
1. $\overline{BE} \cong \overline{CE}$ , $\overline{DE} \cong \overline{AE}$	1. Given
2. $BE = CE$ , $DE = AE$	2. Definition of $\cong$ segments
3. $AB = AE + EB$ , $DC = ED + EC$	3. Segment Addition Postulate
4. $AB = DE + CE$ , $DC = ED + EC$	4. Substitution Property of Equality
5. $AB = CD$	5. Transitive Property of Equality
6. $\overline{AB} \cong \overline{CD}$	6. Definition of $\cong$ segments

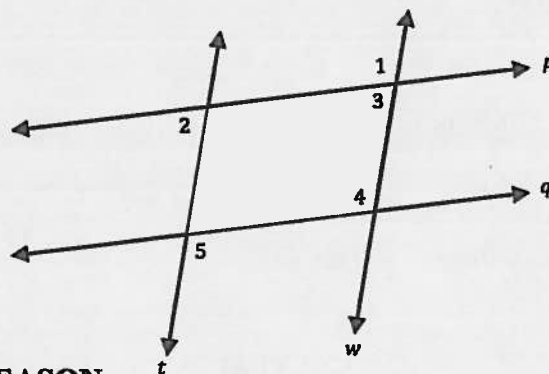
18. Given:  $\angle 1 \cong \angle 2$  and  $\angle 3 \cong \angle 4$

Prove:  $l \parallel m$



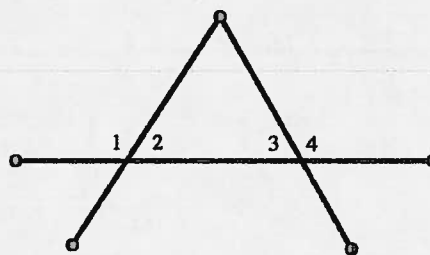
STATEMENT	REASON
1. $\angle 1 \cong \angle 2$	1. Given
2. $q \perp l$	2. Linear Pair $\cong \angle$ s Theorem
3. $\angle 3 \cong \angle 4$	3. Given
4. $q \perp m$	4. Linear Pair $\cong \angle$ s Theorem
5. $l \parallel m$	5. Perpendicular Transversal Theorem

19. Given:  $\angle 2 \cong \angle 3$  and  $\angle 1 \cong \angle 5$   
 Prove:  $p \parallel q$



STATEMENT	REASON
1. $\angle 2 \cong \angle 3$	1. Given
2. $t \parallel w$	2. Corresponding $\angle$ s Converse Theorem
3. $\angle 1 \cong \angle 5$	3. Given
4. $\angle 4 \cong \angle 5$	4. Alternate Interior $\angle$ s Theorem
5. $\angle 1 \cong \angle 4$	5. Transitive Property of Congruence
6. $p \parallel q$	6. Corresponding $\angle$ s Converse Theorem

20. Given:  $\angle 2 \cong \angle 3$   
 Prove:  $\angle 1 \cong \angle 4$



STATEMENT	REASON
1. $\angle 2 \cong \angle 3$	1. Given
2. $m\angle 2 = m\angle 3$	2. Definition of $\cong \angle$ s
3. $m\angle 1 + m\angle 2 = 180^\circ$ $m\angle 3 + m\angle 4 = 180^\circ$	3. Linear Pair Theorem
4. $m\angle 1 + m\angle 2 = m\angle 3 + m\angle 4$	4. Transitive Property of Equality
5. $m\angle 1 + m\angle 3 = m\angle 3 + m\angle 4$	5. Substitution Property of Equality
6. $m\angle 3 = m\angle 3$	6. Reflexive Property of Equality
7. $m\angle 1 = m\angle 4$	7. Subtraction Property of Equality
8. $\angle 1 \cong \angle 4$	8. Definition of $\cong \angle$ s

