

Junior High Math League  
Sample Questions by Meet and Topic  
Meet 3

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Meet 3

- 3.1 Using Exponents
- 3.2 Writing Equivalent Expressions
- 3.3 Dimensional Analysis (Unit Conversion)
- 3.4 Solving More Complex One-Variable Equations
- 3.5 Solving Inequalities
- 3.6 Angle Relationships

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### 3.1 Using Exponents

\_\_\_\_\_ 8. Simplify and write with only positive exponents:  $\frac{4x^{-2}y}{16x^{-3}y^3}$ .

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### 3.1 Using Exponents

\_\_\_\_\_ 3.  $2^3 \cdot 4^{-1} = ?$

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### 3.1 Using Exponents

\_\_\_\_\_ 1.  $2^3 \cdot 4^{-1} \cdot 8^{-2} \cdot 16^2 \cdot 32^{-1} = ?$

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### 3.1 Using Exponents

\_\_\_\_\_ 1. Write 45600 in scientific notation.

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### 3.1 Using Exponents

\_\_\_\_\_1. Write in scientific notation: 0.000205

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### 3.1 Using Exponents

\_\_\_\_\_4. What is 36800000 divided by  $2 \times 10^{-4}$  in scientific notation?

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### 3.2 Writing Equivalent Expressions

\_\_\_\_\_ 1. Simplify:  $3(x+2) - 4(x-5)$

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### 3.2 Writing Equivalent Expressions

\_\_\_\_\_ 2. Simplify:  $3(x-2) + 8x - 2(x+4)$

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\_\_\_\_\_ 3. Simplify:  $3(x-1)(4+x) + 10$

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### 3.2 Writing Equivalent Expressions

\_\_\_\_\_ 4. Simplify:  $3(x+4) - 2(8+x) + 10 - x(x+3)$

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### 3.3 Dimensional Analysis (Unit Conversion)

\_\_\_\_\_ <sup>cm</sup>2. How many centimeters are in the sum of 115 mm and 20 cm and 1 m?

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### 3.3 Dimensional Analysis (Unit Conversion)

\_\_\_\_\_ <sup>mph</sup>8. In Canada the speed limits are posted in Km/hr. If six tenths of a mile is one kilometer, what speed is 90 Km/hr in miles per hour?

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### 3.3 Dimensional Analysis (Unit Conversion)

\_\_\_\_\_ m 1. How many meters is half a millimeter?

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### 3.3 Dimensional Analysis (Unit Conversion)

\_\_\_\_\_ min 4. How many minutes are there from 12:48 PM until 2:06 PM?

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### 3.3 Dimensional Analysis (Unit Conversion)

- \_\_\_\_\_ 4. If one quart, one pint, and one cup of water are poured from one gallon, how much is left?

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### 3.3 Dimensional Analysis (Unit Conversion)

- \_\_\_\_\_ 7. Martha's quilt needed 75 squares of green material. Each square was 6 inches on a side. If a bolt of fabric is 44 inches wide, what length of fabric is needed, rounding up to the nearest  $\frac{1}{4}$  of a yard?

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### 3.3 Dimensional Analysis (Unit Conversion)

\_\_\_\_\_ 4. It is now four times as long since noon as it will be until 1 pm. What time is it?

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### 3.4 Solving More Complex One-Variable Equations

\_\_\_\_\_ 5. Solve for  $x$ :  $3(x+2) - 4(x-5) = 10(x-4)$ .

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### 3.4 Solving More Complex One-Variable Equations

\_\_\_\_\_8. Solve for  $x$ :  $3(x-2) = 8x - 2(x+4)$ .

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### 3.4 Solving More Complex One-Variable Equations

\_\_\_\_\_10. Solve for  $x$ :  $3(x-1) - 2(4+x) = 10$ .

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### 3.4 Solving More Complex One-Variable Equations

\_\_\_\_\_ 3. Solve for both values of  $x$ :  $|2x - 1| = 5$ .

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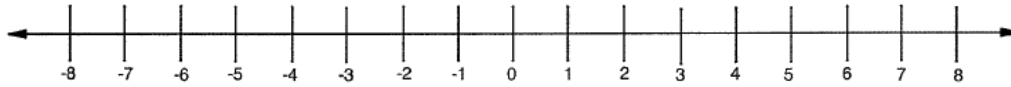
### 3.5 Solving Inequalities

\_\_\_\_\_ 6. Write as an inequality:  $x$  is at most three.

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### 3.5 Solving Inequalities

4. Graph all possible  $x$  values for  $|x - 3| \leq 2$ :



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### 3.5 Solving Inequalities

\_\_\_\_\_ 8. Write the absolute value inequality for  $3 \leq x \leq 9$ .

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### 3.5 Solving Inequalities

\_\_\_\_\_ 1. Solve for  $x$ :  $3(x-1) < -27$ .

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### 3.5 Solving Inequalities

\_\_\_\_\_ 2. Solve for  $x$ :  $-5x > 25$ .

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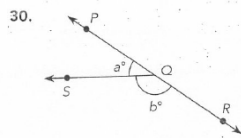
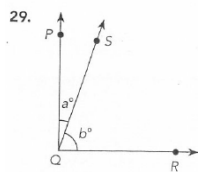
### 3.5 Solving Inequalities

\_\_\_\_\_ 3. Solve for  $x$ :  $3 - 2x > 9$ .

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### 3.6 Angle Relationships

In the diagram, the ratio of  $a$  to  $b$  is  $1 : 4$ . Find the values of  $a$  and  $b$ .

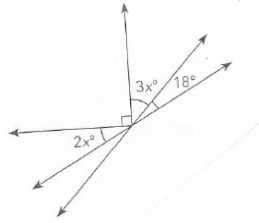


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### 3.6 Angle Relationships

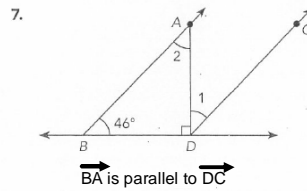
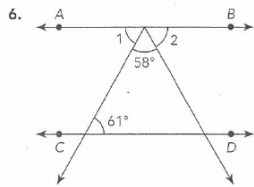
Find the value of  $x$ .

8.



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### 3.6 Angle Relationships



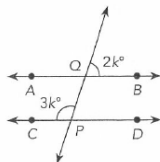
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### 3.6 Angle Relationships

$\overleftrightarrow{AB}$  is parallel to  $\overleftrightarrow{CD}$ . Find the value of each variable.

10.



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- 3.6 Angle Relationships

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### 3.1 Using Exponents

\_\_\_\_\_ 8. Simplify and write with only positive exponents:  $\frac{4x^{-2}y}{16x^{-3}y^3}$ .

Answer =

$$\frac{x}{4y^2} \text{ or } \frac{1x}{4y^2} \quad 8. \quad \frac{4x^3y}{16x^2y^3} = \frac{1x}{4y^2}$$

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### 3.1 Using Exponents

\_\_\_\_\_ 3.  $2^3 \cdot 4^{-1} = ?$

Answer =

$$\underline{2} \quad 3. \quad 2^3 \cdot 4^{-1} = \frac{2^3}{4} = \frac{8}{4} = 2 \text{ or } 4^{-1} = (2^2)^{-1} = 2^{-2} \text{ so } 2^3 \cdot 2^{-2} = 2^1 = 2$$

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### 3.1 Using Exponents

\_\_\_\_\_ 1.  $2^3 \cdot 4^{-1} \cdot 8^{-2} \cdot 16^2 \cdot 32^{-1} = ?$

Answer =

$\frac{1}{4}$  1.  $2^3 \cdot (2^2)^{-1} \cdot (2^3)^{-2} \cdot (2^4)^2 \cdot (2^5)^{-1} = 2^3 \cdot 2^{-2} \cdot 2^{-6} \cdot 2^8 \cdot 2^{-5} = 2^{3-2-6+8-5} = 2^{-2} = \frac{1}{2^2}$

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### 3.1 Using Exponents

\_\_\_\_\_ 1. Write 45600 in scientific notation.

Answer =

$4.56 \times 10^4$  1.  $45600 = 4.56 \times 10^4$

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### 3.1 Using Exponents

\_\_\_\_\_ 1. Write in scientific notation: 0.000205

Answer =

$2.05 \times 10^{-4}$  1.  $0.000205 = 2.05 \times 10^{-4}$

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### 3.1 Using Exponents

\_\_\_\_\_ 4. What is 36800000 divided by  $2 \times 10^{-4}$  in scientific notation?

Answer =

$1.84 \times 10^{11}$  4.  $36800000 = 3.68 \times 10^7$ ,  $\frac{3.68 \times 10^7}{2 \times 10^{-4}} = 1.84 \times 10^{7-(-4)}$

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## 3.2 Writing Equivalent Expressions

\_\_\_\_\_ 1. Simplify:  $3(x+2) - 4(x-5)$

Answer =  $-x + 26$

Distribute:  $3x + 6 - 4x + 20$

Combine:  $-x + 26$

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## 3.2 Writing Equivalent Expressions

\_\_\_\_\_ 2. Simplify:  $3(x-2) + 8x - 2(x+4)$

Answer =  $9x - 14$

Distribute:  $3x - 6 + 8x - 2x - 8$

Combine:  $9x - 14$

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## 3.2 Writing Equivalent Expressions

\_\_\_\_\_ 3. Simplify:  $3(x-1)(4+x) + 10$

$$\text{Answer} = 3x^2 + 9x - 2$$

$$\text{Distribute: } (3x-3)(4+x) + 10$$

$$\text{Distribute: } 12x + 3x^2 - 12 - 3x + 10$$

$$\text{Combine: } 3x^2 + 9x - 2$$

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## 3.2 Writing Equivalent Expressions

\_\_\_\_\_ 4. Simplify:  $3(x+4) - 2(8+x) + 10 - x(x+3)$

$$\text{Answer} = -x^2 - 2x + 6$$

$$\text{Distribute: } 3x + 12 - 16 - 2x + 10 - x^2 - 3x$$

$$\text{Combine: } -x^2 - 2x + 6$$

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### 3.3 Dimensional Analysis (Unit Conversion)

\_\_\_\_\_ cm<sup>2</sup>. How many centimeters are in the sum of 115 mm and 20 cm and 1 m?

Answer =

131.5 cm 2.  $11.5 \text{ cm} + 20 \text{ cm} + 100 \text{ cm} = 131.5 \text{ cm}$

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### 3.3 Dimensional Analysis (Unit Conversion)

\_\_\_\_\_ mph<sup>8</sup>. In Canada the speed limits are posted in Km/hr. If six tenths of a mile is one kilometer, what speed is 90 Km/hr in miles per hour?

Answer =

54 mph 8.  $90 \times 0.6 = 54.0 \text{ mph}$

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### 3.3 Dimensional Analysis (Unit Conversion)

         m 1. How many meters is half a millimeter?

Answer =

0.0005m 1.  $0.5\text{mm} = 0.05\text{cm} = 0.0005\text{m}$

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### 3.3 Dimensional Analysis (Unit Conversion)

         min 4. How many minutes are there from 12:48 PM until 2:06 PM?

Answer =

78 min. 4.  $2:06 = 14:06$  so 
$$\begin{array}{r} 14:06 \Rightarrow 13:66 \\ -12:48 \\ \hline 1:18 = 60 + 18 = 78\text{min} \end{array}$$

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### 3.3 Dimensional Analysis (Unit Conversion)

\_\_\_\_\_ 4. If one quart, one pint, and one cup of water are poured from one gallon, how much is left?

Answer =

2 qt 1 cup 4.  $3qt + 1pt + 2c - 1qt - 1pt - 1c = 2 \text{ qt } 1 \text{ cup}$

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### 3.3 Dimensional Analysis (Unit Conversion)

\_\_\_\_\_ 7. Martha's quilt needed 75 squares of green material. Each square was 6 inches on a side. If a bolt of fabric is 44 inches wide, what length of fabric is needed, rounding up to the nearest 1/4 of a yard?

Answer =

2 yards 7.  $44 \div 6 = 7$  squares in each row.  $75 \div 7 = 10 \frac{5}{7} = 11$  rows needed.  
 $11 \cdot 6 \text{ inches} = 66 \text{ inches of length. } (1/4) \cdot 36 = 9 \text{ inches in a quarter yard}$   
 $66 \div 9 = 7 \frac{1}{3} = 8 \text{ quarters} = 2 \text{ yards}$

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### 3.3 Dimensional Analysis (Unit Conversion)

\_\_\_\_\_ 4. It is now four times as long since noon as it will be until 1 pm. What time is it?

Answer =

12:48 pm 4. From noon until 1 is 60 minutes.  
 $4x + x = 60$ ,  $5x = 60$ ,  $x = 12$ ,  $60 - 12 = 48$

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### 3.4 Solving More Complex One-Variable Equations

\_\_\_\_\_ 5. Solve for  $x$ :  $3(x+2) - 4(x-5) = 10(x-4)$ .

Answer =

6 5.  $3x + 6 - 4x + 20 = 10x - 40$ ,  $-x + 26 = 10x - 40$ ,  $66 = 11x$ ,  $x = 6$

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### 3.4 Solving More Complex One-Variable Equations

\_\_\_\_\_ 8. Solve for  $x$ :  $3(x-2) = 8x - 2(x+4)$ .

Answer =

   $\frac{2}{3}$    8.  $3x - 6 = 8x - 2x - 8$ ,  $3x - 6 = 6x - 8$ ,  $-6 = 3x - 8$ ,  $2 = 3x$ ,  $x = \frac{2}{3}$

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### 3.4 Solving More Complex One-Variable Equations

\_\_\_\_\_ 10. Solve for  $x$ :  $3(x-1) - 2(4+x) = 10$ .

Answer =

  21   10.  $3x - 3 - 8 - 2x = 10$ ,  $x - 11 = 10$ ,  $x = 21$

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### 3.4 Solving More Complex One-Variable Equations

\_\_\_\_\_ 3. Solve for both values of  $x$ :  $|2x - 1| = 5$ .

Answer =

$$\underline{-2, 3} \quad 3. \quad \begin{array}{l} 2x - 1 = 5 \\ +1 +1 \\ \hline 2x = 6 \\ x = 3 \end{array} \quad \text{or} \quad \begin{array}{l} 2x - 1 = -5 \\ +1 +1 \\ \hline 2x = -4 \\ x = -2 \end{array}$$

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### 3.5 Solving Inequalities

\_\_\_\_\_ 6. Write as an inequality:  $x$  is at most three.

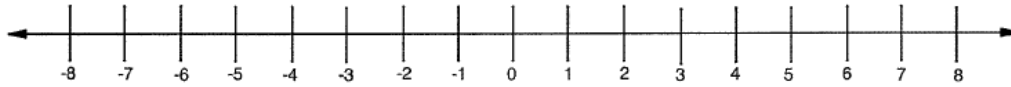
Answer =

$x \leq 3$  6. "at most" means 3 or less

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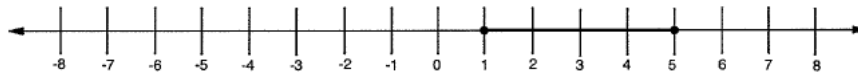
### 3.5 Solving Inequalities

4. Graph all possible  $x$  values for  $|x - 3| \leq 2$ :



Answer =

4.  $x - 3 \leq 2, x \leq 5$  and  $x - 3 \geq -2, x \geq 1$



(must be a line segment, not just the integers)

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### 3.5 Solving Inequalities

\_\_\_\_\_ 8. Write the absolute value inequality for  $3 \leq x \leq 9$ .

Answer =

$|x - 6| \leq 3$  8. The center value is  $\frac{3+9}{2} = 6$  and 3 and 9 are both 3 units from 6, so

$$|x - 6| \leq 3$$

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### 3.5 Solving Inequalities

\_\_\_\_\_ 1. Solve for  $x$ :  $3(x-1) < -27$ .

Answer =

$x < -8$  1.  $3x - 3 < -27$ ,  $3x < -24$ ,  $x < -8$

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### 3.5 Solving Inequalities

\_\_\_\_\_ 2. Solve for  $x$ :  $-5x > 25$ .

Answer =

$x < -5$  2.  $\frac{-5x}{-5} > \frac{25}{-5}$ ,  $x < -5$

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### 3.5 Solving Inequalities

\_\_\_\_\_ 3. Solve for  $x$ :  $3 - 2x > 9$ .

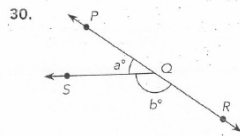
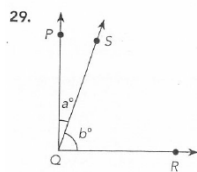
Answer =

$x < -3$  3.  $3 - 2x > 9$ ,  $-2x > 6$ ,  $x < -3$

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### 3.6 Angle Relationships

In the diagram, the ratio of  $a$  to  $b$  is 1 : 4. Find the values of  $a$  and  $b$ .



Answer =

29.  $a : b = 1 : 4$   
 So,  $b^\circ = 4a^\circ$ .  
 $a^\circ + b^\circ = 90^\circ$  (Comp.  $\angle$ s)  
 $a^\circ + 4a^\circ = 90^\circ$   
 $5a = 90$   
 $\frac{5a}{5} = \frac{90}{5}$   
 $a = 18$   
 $b = 4 \cdot 18$   
 $= 72$

30.  $a : b = 1 : 4$   
 So,  $b^\circ = 4a^\circ$ .  
 $a^\circ + b^\circ = 180^\circ$  (Supp.  $\angle$ s)  
 $a^\circ + 4a^\circ = 180^\circ$   
 $5a = 180$   
 $\frac{5a}{5} = \frac{180}{5}$   
 $a = 36$   
 $b = 4 \cdot 36$   
 $= 144$

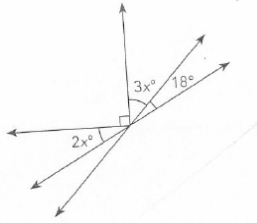
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### 3.6 Angle Relationships

Find the value of  $x$ .

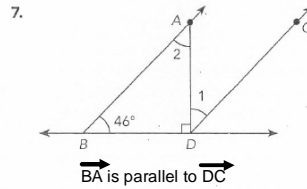
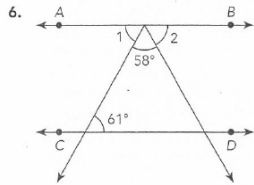
8.



Answer = #8.  $2x^\circ + 90^\circ + 3x^\circ + 18^\circ = 180^\circ$  ( $\angle$ s at a point)  
 $5x^\circ + 108^\circ = 180^\circ$   
 $5x^\circ + 108^\circ - 108^\circ = 180^\circ - 108^\circ$   
 $5x = 72$   
 $\frac{5x}{5} = \frac{72}{5}$   
 $x = 14.4$

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### 3.6 Angle Relationships



Answer = #6.  $m\angle 1 = 61^\circ$  (Alt. int.  $\angle$ s)  
 $m\angle 1 + m\angle 2 + 58^\circ = 180^\circ$  (Supp.  $\angle$ s)  
 $61^\circ + m\angle 2 + 58^\circ = 180^\circ$  (Supp.  $\angle$ s)  
 $m\angle 2 + 119^\circ = 180^\circ$   
 $m\angle 2 + 119^\circ - 119^\circ = 180^\circ - 119^\circ$   
 $m\angle 2 = 61^\circ$

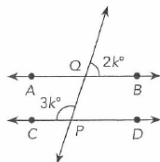
#7.  $m\angle 2 + 90^\circ + 46^\circ = 180^\circ$  ( $\angle$  sum of triangle)  
 $m\angle 2 + 136^\circ = 180^\circ$   
 $m\angle 2 + 136^\circ - 136^\circ = 180^\circ - 136^\circ$   
 $m\angle 2 = 44^\circ$   
 $m\angle 1 = 44^\circ$  (Alt. int.  $\angle$ s)

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### 3.6 Angle Relationships

$\overline{AB}$  is parallel to  $\overline{CD}$ . Find the value of each variable.

10.



Answer = 10.  $m\angle QPD = 2k^\circ$  (Corr.  $\angle$ s)  
 $2k^\circ + 3k^\circ = 180^\circ$  (Supp.  $\angle$ s)  
 $5k = 180$   
 $\frac{5k}{5} = \frac{180}{5}$   
 $k = 36$

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