Lesson 12.1  Angles on a Line

Find the unknown marked angles. The diagrams are not drawn to scale.

1. $\overrightarrow{AC}$ is a line. Find the measure of $\angle DBE$.

2. $\overrightarrow{PR}$ is a line. Find the measure of $\angle PQT$. 
3. \( \overrightarrow{CE} \) is a line. Find the measure of \( \angle FDG \).

![Image of intersecting lines with angles labeled: 29°, 37°, 58°.]

4. \( \overrightarrow{SU} \) is a line. The measure of \( \angle y \) is twice as big as the measure of \( \angle x \) and the measure of \( \angle z \) is half the measure of a right angle. Find the measure of \( \angle y \).

![Image of intersecting lines with angles labeled: \( x \), \( y \), and \( z \).]
Lesson 12.2  Angles at a Point

Find the unknown marked angles. The diagrams are not drawn to scale.

1. Find the measure of $\angle a$.

2. Find the measure of $\angle b$. 

Name: ___________________________  Date: ______________
3. \( \overrightarrow{AB} \) and \( \overrightarrow{CD} \) meet at \( O \). Find the measure of \( \angle c \).

![Diagram](image)

4. \( \overrightarrow{AB} \) is a line. The measure of \( \angle e \) is 2 times the measure of \( \angle d \). Find the measures of \( \angle d \) and \( \angle e \).

![Diagram](image)
Lesson 12.3  Vertical Angles

Find the unknown marked angles. The diagrams are not drawn to scale.

1. $\overrightarrow{AB}$, $\overrightarrow{CD}$, and $\overrightarrow{EF}$ meet at $G$. Find the measure of $\angle DGE$.

2. $\overrightarrow{AB}$, $\overrightarrow{CD}$, $\overrightarrow{EF}$, and $\overrightarrow{GH}$ meet at $O$. Find the measure of $\angle EOH$. 
3. \( \overrightarrow{AB} \) and \( \overrightarrow{CD} \) meet at \( E \) and \( \overrightarrow{EF} \) is perpendicular to \( \overrightarrow{CD} \). Find the measure of \( \angle AEF \).

4. \( \overrightarrow{AB} \) and \( \overrightarrow{CD} \) meet at \( O \). Find the measure of \( \angle BOE \).
5. Look at the marked angles in the diagram. In the table below, write all sets of:
   a. angles at a point,
   b. vertical angles, and
   c. angles on a line

<table>
<thead>
<tr>
<th>Angles at a Point</th>
<th>Vertical Angles</th>
<th>Angles on a Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\angle a$, $\angle b$, $\angle c$, and $\angle d$</td>
<td>$\angle b$ and $\angle d$</td>
<td>$\angle b$ and $\angle c$</td>
</tr>
</tbody>
</table>
Find the unknown marked angles. The diagrams are not drawn to scale.

6. $ABCD$ is a square. The measure of $\angle ADE$ is $42^\circ$. Find the measure of $\angle EDF$.

7. $DF$ is a line and $\overline{OA}$ is perpendicular to $\overline{OB}$. Find the measure of $\angle COE$. 
Put on Your Thinking Cap!

Find the measures of the unknown angles.

1. \( \overrightarrow{AB} \) and \( \overrightarrow{EF} \) meet at \( D \). \( \overrightarrow{DC} \) is perpendicular to \( \overrightarrow{AB} \) and \( \overrightarrow{DG} \) is perpendicular to \( \overrightarrow{EF} \). Find the measure of \( \angle x \).

\[ \text{Diagram:}\]
\[ \text{\( \theta \)} \]
\[ \text{(49°)} \]

2. In the diagram, the sum of \( \angle x \) and \( \angle y \) is 124°, the sum of \( \angle y \) and \( \angle z \) is 142°, and the sum of \( \angle x \) and \( \angle z \) is 94°. Find the measures of \( \angle x \), \( \angle y \), and \( \angle z \).
3. In the diagram, the ratio of the measures of $\angle x$ to $\angle y$ is 3 : 4.
The measure of $\angle x$ is $51^\circ$.
Find the measure of $\angle z$.

4. $\overrightarrow{AB}$ and $\overrightarrow{CD}$ meet at $G$. The ratio of the measures of $\angle x$ to $\angle y$ is 5 : 2.
Find the measure of $\angle z$. 
5. In the diagram, the measure of $\angle p$ is 7 times the measure of $\angle q$ and the measure of $\angle r$ is 4 times the measure of $\angle q$. Find the measures of $\angle p$ and $\angle r$.

6. In the diagram, the measures of $\angle a$, $\angle b$, and $\angle c$ are in the ratio 3 : 4 : 5. Find the measures of $\angle a$, $\angle b$, and $\angle c$. 
7. In the diagram, \( \angle c \) lies on a line. The measure of \( \angle a \) is \( \frac{2}{3} \) of \( \angle d \), the measure of \( \angle d \) is \( \frac{3}{4} \) of \( \angle b \), and the measure \( \angle b \) is \( \frac{4}{9} \) of \( \angle c \). Find the measures of \( \angle a \), \( \angle b \), \( \angle c \), and \( \angle d \).

8. \( \overrightarrow{AF} \) is a line. \( \angle AOB \) and \( \angle COD \) are right angles. The measure of \( \angle EOC \) is 130° and the measure of \( \angle EOF \) is 108°. What can you say about the measures of \( \angle BOC \) and \( \angle DOF \)?