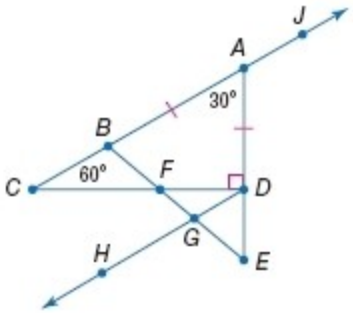
1-5 Angle Relationships

Name an angle or angle pair that satisfies each condition.



14. a linear pair whose vertex is *F*

SOLUTION:

Sample answer: A linear pair is a pair of adjacent angles with noncommon sides that are opposite rays. $\angle BFC$ and $\angle BFD$ are linear pair with vertex *F*, $\angle GFD$ and $\angle GFC$ are linear pair with vertex *F*.

ANSWER:

Sample answer: $\angle BFC$, $\angle BFD$

16. an angle supplementary to $\angle CBF$

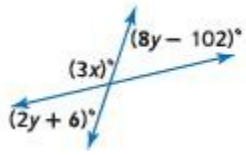
SOLUTION:

Sample answer: Supplementary angles are two angles with measures that have a sum of 180. Since $m\angle CBF + m\angle JBF = 180$, $\angle JBF$ is supplementary to $\angle CBF$.

ANSWER:

Sample answer: $\angle JBF$

Find the value of each variable.

22. 

SOLUTION:

In the figure, $(8y-102)°$ angle and $(2y+6)°$ angle are vertical angles.
Vertical angles are congruent. So, $(8y-102)° = (2y+6)°$.

$8y-102=2y+6$	Def. of Vertical Angles.
$8y-2y-102=2y-2y+6$	$-2y$ from each side.
$6y-102=6$	Simplify.
$6y-102+102=6+102$	$+102$ to each side.
$6y=108$	Simplify.
$\frac{6y}{6}=\frac{108}{6}$	÷ each side by 6.
$y=18$	Simplify.

The angles in a linear pair are supplementary. So, $(8y-102)° + (3x)° = 180°$.

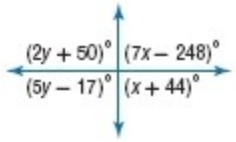
$(8y-102)+(3x)=180$	Def.of Supplementary Angles.
$8(18)-102+3x=180$	Replace y with 18.
$144-102+3x=180$	Multiply.
$42+3x=180$	Subtraction.
$42-42+3x=180-42$	Subtract 42 from each side.
$3x=138$	Simplify.
$\frac{3x}{3}=\frac{138}{3}$	Divide each side by 3.
$x=46$	Simplify.

So, the values of the variables are $x = 46$ and $y = 18$.

ANSWER:

$x = 46; y = 18$

1-5 Angle Relationships

23. 

SOLUTION:

Supplementary angles have measures that sum to 180. So, $(2y + 50)° + (5y - 17)° = 180°$ and $(x + 44)° + (7x - 248)° = 180°$.

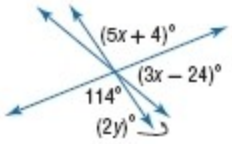
Consider $(2y + 50)° + (5y - 17)° = 180°$.

$2y + 50 + 5y - 17 = 180$	Def. of Supplementary Angles.
$7y + 33 = 180$	Simplify.
$7y + 33 - 33 = 180 - 33$	−33 from each side.
$7y = 147$	Simplify.
$\frac{7y}{7} = \frac{147}{7}$	÷ each side by 7.
$y = 21$	Simplify.

$7x - 248 + x + 44 = 180$	Def. of Supplementary Angles.
$8x - 204 = 180$	Simplify.
$8x - 204 + 204 = 180 + 204$	Add 204 to each side.
$8x = 384$	Simplify.
$\frac{8x}{8} = \frac{384}{8}$	Divide each side by 8.
$x = 48$	Simplify.

ANSWER:

$x = 48; y = 21$

24. 

SOLUTION:

In the figure, $(5x + 4)°$ angle and $(114)°$ angle are vertical angles.

Vertical angles are congruent. So, $(5x + 4)° = 114°$.

$5x + 4 = 114$	Def. of Vertical Angles.
$5x + 4 - 4 = 114 - 4$	−4 from each side.
$5x = 110$	Simplify.
$\frac{5x}{5} = \frac{110}{5}$	÷ each side by 5.
$x = 22$	Simplify.

In the figure, $114° + (3x - 24)° + (2y)° = 180°$.

$114 + 3x - 24 + 2y = 180$	Def. of Supplementary Angles.
$3x + 2y + 90 = 180$	Subtraction.
$3(22) + 2y + 90 = 180$	Replace x with 22.
$66 + 2y + 90 = 180$	Mutliply.
$2y + 156 = 180$	Addition.
$2y + 156 - 156 = 180 - 156$	Subtract 156 from each side.
$2y = 24$	Simplify.
$\frac{2y}{2} = \frac{24}{2}$	Divide each side by 2.
$y = 12$	Simplify.

ANSWER:

$x = 22; y = 12$

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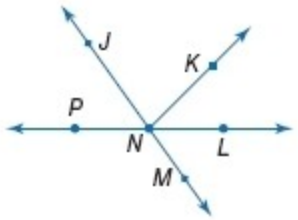
ALGEBRA Use the figure below.



29. If $m\angle KNL = 6x - 4$ and $m\angle LNM = 4x + 24$, find the value of x so that $\angle KNM$ is a right angle.

SOLUTION:

In the figure, $m\angle KNL + m\angle LNM = m\angle KNM$. Since $\angle KNM$ is a right angle, $m\angle KNM = 90$.

$$\begin{aligned}
m\angle KNL + m\angle LNM &= m\angle KNM && \text{Def. of Right Angle.}\\
(6x-4)+(4x+24) &= 90 && \text{Substitution.}\\
10x+20 &= 90 && \text{Addition.}\\
10x+20-20 &= 90-20 && -20 \text{ from each side.}\\
10x &= 70 && \text{Simplify.}\\
\frac{10x}{10} &= \frac{70}{10} && \div \text{ each side by 10.}\\
x &= 7 && \text{Simplify.}
\end{aligned}$$

ANSWER:

7

30. If $m\angle JNP = 3x - 15$ and $m\angle JNL = 5x + 59$, find the value of x so that $\angle JNP$ and $\angle JNL$ are supplements of each other.

SOLUTION:

Supplementary angles are two angles with measures that have a sum of 180. Then, $m\angle JNP + m\angle JNL = 180$.

$$\begin{aligned}
m\angle JNP + m\angle JNL &= 180 && \text{Def. of Supplementary Angles.}\\
(3x-15)+(5x+59) &= 180 && \text{Substitution.}\\
8x+44 &= 180 && \text{Simplify.}\\
8x+44-44 &= 180-44 && \text{Subtract 44 from each side.}\\
8x &= 136 && \text{Simplify.}\\
\frac{8x}{8} &= \frac{136}{8} && \text{Divide each side by 8.}\\
x &= 17 && \text{Simplify.}
\end{aligned}$$

ANSWER:

17

31. If $m\angle LNM = 8x + 12$ and $m\angle JNL = 12x - 32$, find $m\angle JNP$.

SOLUTION:

The angles in a linear pair are supplementary. So, $m\angle LNM + m\angle JNL = 180$.

$$\begin{aligned}
m\angle LNM + m\angle JNL &= 180 && \text{Def. of Linear Pair.}\\
(8x+12)+(12x-32) &= 180 && \text{Substitution.}\\
20x-20 &= 180 && \text{Simplify.}\\
20x-20+20 &= 180+20 && +20 \text{ to each side.}\\
20x &= 200 && \text{Simplify.}\\
\frac{20x}{20} &= \frac{200}{20} && \div \text{ each side by 20.}\\
x &= 10 && \text{Simplify.}
\end{aligned}$$

$\angle LNM$ and $\angle JNP$ are vertical angles. Since the vertical angles are congruent, $m\angle LNM = m\angle JNP$.

Substitute $x = 10$ in $m\angle LNM = 8x + 12$.

$$\begin{aligned}
m\angle LNM &= 8(10)+12\\
&= 92
\end{aligned}$$

So, $\angle JNP = 92$.

ANSWER:

92

32. If $m\angle JNP = 2x + 3$, $m\angle KNL = 3x - 17$, and $m\angle KNJ = 3x + 34$, find the measure of each angle.

SOLUTION:

In the figure, $m\angle KNL + m\angle JNP + m\angle KNJ = 180$.

$$\begin{aligned}
m\angle KNL + m\angle JNP + m\angle KNJ &= 180 && \text{Def. of Supplementary Angles.}\\
(3x-17) + (2x+3) + (3x+34) &= 180 && \text{Substitution.}\\
8x + 20 &= 180 && \text{Simplify.}\\
8x + 20 - 20 &= 180 - 20 && \text{Subtract 20 from each side.}\\
8x &= 160 && \text{Simplify.}\\
\frac{8x}{8} &= \frac{160}{8} && \text{Divide each side by 8.}\\
x &= 20 && \text{Simplify.}
\end{aligned}$$

Find $m\angle JNP$.

Substitute $x = 20$ in $m\angle JNP = 2x + 3$.

$$\begin{aligned}
m\angle JNP &= 2(20) + 3\\
&= 43
\end{aligned}$$

Find $m\angle KNL$.

Substitute $x = 20$ in $m\angle KNL = 3x - 17$.

$$\begin{aligned}
m\angle KNL &= 3(20) - 17\\
&= 43
\end{aligned}$$

Find $m\angle KNJ$.

Substitute $x = 20$ in $m\angle KNJ = 3x + 34$.

$$\begin{aligned}
m\angle KNJ &= 3(20) + 34\\
&= 94
\end{aligned}$$

ANSWER:

$m\angle JNP = 43$; $m\angle KNL = 43$; $m\angle KNJ = 94$