Translating Word Problems into Algebraic Expressions

1) Two integers have a sum of 24. If the first integer is called \( m \), create an expression for the second integer in terms of \( m \).

\[
\begin{align*}
\text{m + x} &= 24 \\
x &= 24 - \text{m}
\end{align*}
\]

2) The perimeter of a rectangle is 100. If the width is called \( w \), create an expression for the length in terms of \( w \).

\[
\begin{align*}
2l + 2w &= 100 \\
2l &= 100 - 2w \\
l &= \frac{100 - 2w}{2}
\end{align*}
\]

3) The perimeter of a right triangle is 30. The hypotenuse is 13. Assuming the triangle is not isosceles and one leg is called \( x \), create an expression for the other leg.

\[
\begin{align*}
x + y + 13 &= 30 \\
y &= 30 - 13 - x \\
17 - x &= \text{other leg}
\end{align*}
\]

4) A rectangle has a perimeter of 50. If the length is called \( L \), create an expression for the width in terms of \( L \).

\[
\begin{align*}
2L + 2w &= 50 \\
2w &= 50 - 2L
\end{align*}
\]

5) Two integers have a sum of 40. The first integer is called \( x \), create an expression for the second integer in terms of \( x \).

\[
\begin{align*}
x + y &= 40 \\
y &= 40 - x
\end{align*}
\]

6) A 3-sided rectangular fence is constructed against the side of a building. If one side of the fence is called \( w \), create an expression for the length of the fence in terms of \( w \) (using 150 ft of fencing).

\[
\begin{align*}
2w + L &= 150 \\
L &= 150 - 2w
\end{align*}
\]

7) I am thinking of three consecutive integers. If the first integer is called \( y \), create an expression for the other two integers.

\[
y, y+1, y+2
\]

8) Two integers are called \( x \) and \( y \). Create an expression that represents their product.

\[
\text{PRODUCT} = x \times y
\]

9) Two integers are called \( x \) and \( y \). Create an expression that represents the sum of their squares.

\[
\text{SUM OF SQUARES} = x^2 + y^2
\]
Creating Polynomials from Word Problems

Use the previous exercises #1-7, to complete the following problems:

1) Two integers have a sum of 24. If the first integer is called \( m \), create a polynomial that represents their product.

\[ \text{Product} = m(24-m) = 24m - m^2 \]

2) The perimeter of a rectangle is 100. If the width is called \( w \), create an expression that represents the area of the rectangle.

\[ \text{Area} = w(50-w) = 50w - w^2 \]

3) The perimeter of a right triangle is 30. The hypotenuse is 13. Assuming the triangle is not isosceles and one leg is called \( x \),
   a) Create an algebraic expression using Pythagorean Theorem.
   b) Create an algebraic expression representing the area of the triangle

\[ a) \quad x^2 + (17-x)^2 = 13^2 \]
\[ x^2 + 289 - 34x + x^2 = 169 \]
\[ 2x^2 - 34x + 130 = 0 \]
\[ \text{Area} = \frac{1}{2} b h \]

\[ b) \quad \text{Area} = \frac{1}{2} (x)(17-x) \]

\[ \text{Area} = \frac{17x - x^2}{2} \]

4) A rectangle has a perimeter of 50. If the length is called \( L \), create an expression for the area of the rectangle in terms of \( L \).

\[ \text{Area} = L(25-L) = 25L - L^2 \]

5) Two integers have a sum of 40. The first integer is called \( x \), create an expression for the sum of their squares.

\[ \text{Sum of Squares} = x^2 + (40-x)^2 \]
\[ = x^2 + 1600 - 80x + x^2 \]

\[ \text{Sum of Squares} = 2x^2 - 80x + 1600 \]

6) A 3-sided rectangular fence is constructed against the side of a building. If one side of the fence is called \( w \), create an expression for the area of the fence in terms of \( w \). (Using 150 ft of fencing)

\[ \text{Area} = w(150 - 2w) = 150w - 2w^2 \]

7) I am thinking of three consecutive integers. If the first integer is called \( y \), create an expression that represents the product of the 2nd and 3rd integers. If the product is 306

\[ y, y+1, y+2 \]
\[ (y+1)(y+2) = 306 \]
\[ y^2 + 3y + 2 = 306 \]
\[ y^2 + 3y - 304 = 0 \]
Creating Polynomials from Word Problems

A high diver jumps off a 10-meter springboard. For 
$h$ in meters and $t$ in seconds after the diver leaves 
the board, her height above the water is given by:

$$h(t) = -4.9t^2 + 8t + 10$$

a) Find the $x$ intercepts. Interpret the values in the 
context of this problem.

$X = -0.829$  $X = 2.46$  Seconds until the diver hits the water
(no meaning)

b) Find the $y$ intercept and interpret its value in the 
context of this problem.

(plug in 0 for $x$)  $y = 10$ feet, the initial height of 
the diver on the spring board

c) Identify concavity  Concave Down

d) Find the diver’s maximum height  13.26 meters

(e) How long does it take the diver to reach max height?

$X = 0.816$  Seconds to reach the max height

(f) What domain and range would we use for this model?

$D: [0, 2.46]$  
$R: [0, 13.26]$  

g) Sketch the graph:
Creating Polynomials from Word Problems

A baseball is popped up by a batter. The height of the ball above the ground after \( t \) seconds is given by the function

\[
f(t) = -16t^2 + 64t + 3
\]

a) Find the \( x \) intercepts. Interpret the values in the context of this problem.
\[ x = -0.046 \quad x = 4.04 \text{ seconds for the ball to hit the ground} \]

b) Find the \( y \) intercept and interpret its value in the context of this problem.
Plug in 0 for \( x \)
\[ y = 3 \text{ feet is the initial height when the ball is hit} \]

c) Identify concavity Concave Down

d) Find the maximum height of the baseball. 67 feet

e) How long does it take the baseball to reach max height? It takes 2 seconds to reach max height

f) What domain and range would we use for this model?
\[ D: [0, 4.04] \]
\[ R: [0, 67] \]

g) Sketch the graph: