What's Going On?

Checking In

Minds on That's Sketchy

Action! Application Problems

Consolidation 4 Parabolas

Learning Goal - I will be able to use the quadratic formula to solve and graph quadratic equations.

Minds on

Steps to sketching quadratics in standard form.

1. Identify the y-intercept.

2. Find the x-value of the vertex (h) using your new best friend. [h = -b/2a].

3. Find the y-value of the vertex (k) by subbing the value found in step 2 into the original equation and solving for y.

4. Use the **discriminant** ($b^2 - 4ac$) OR the **vertex** OR the **vertex and a-value** to determine how many real and distinct roots the quadratic has.

4. If there are two real roots, find them.
   - First try to solve by factoring
     (**factor out the a-value**)
   - If you cannot factor. Use the quadratic formula.

5. Draw a set of x-y axes. Be sure to make the axes so they fit your parabola.

6. Plot and label the y-intercept, the vertex, and the x-intercepts (if there are any).
   (**approximate if irrational**)

7. Draw and label the axis of symmetry.

8. Plot one more point by reflecting the y-intercept across the axis of symmetry.

9. Draw a line through the points, curvy style.
   *Don't forget the arrows at the end!!

Minds on

4 parabolas...

SKETCH using roots, the vertex, and the y-intercept, and **at least** 3 points.

4 $y = 2x^2 + 7x + 12$

y-intercept

$y = 12$

Vertex

$h = \frac{-b}{2a}$

$= \frac{-7}{4}$

$= -1.75$

$y = 2(-1.75)^2 + 7(-1.75) + 12$

$y = 5.875$

There are no real roots!
To sketch, plot and label the vertex, the y-intercept and the axis of symmetry. Then, reflect the y-intercept across the axis of symmetry to get one more point.

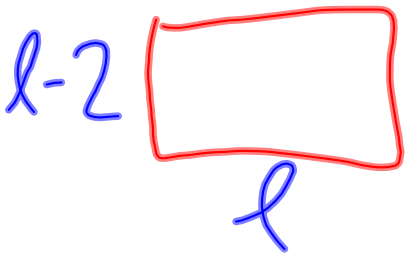
Draw a curve through the points, add the arrows and you are done!

Action!

Application Problems The Set-Up

Pg. 274

1. The width of a rectangle is 2 m less than the length.
   The area of the rectangle is 48 m^2. Find the dimensions of the rectangle.



Let ℓ represent the length of the rectangle.

$A = \ell \times w$

$48 = (\ell)(\ell - 2)$

$\ell^2 - 2\ell = 48$

$-48 \quad -48$

$\ell^2 - 2\ell - 48 = 0$

Solve $l^2 - 2l - 48 = 0$

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

The roots are $l = 8, -6$

∴ the length is 8 m

because the length cannot be negative.

The width is 6m only because it is "2m less than the length"!!

Action!

"Solving" Quadratic Application Problems

0. Draw and label a **rough** diagram.

1. Use the information provided in the question to set up a relation.
Be sure to declare your variable(s)!!

2. **Expand** / **simplify** / **rearrange** to get your relation into the form:

$$ax^2 + bx + c = 0$$

3. Solve your quadratic equation by **factoring** or using the **quadratic formula**.

4. Consider the situation and decide what **solution(s)** / **root(s)** are actually possible.

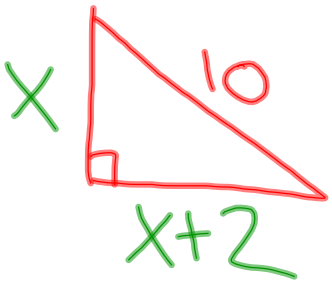
Action!

Application Problems
The Set-Up

Pg. 276
#7

2. The hypotenuse of a right triangle measures 10 m. One of the other two sides is 2 m longer than the third side. Find the unknown side lengths.

Let x represent the shorter side.



$a^2+b^2=c^2$

$(x)^2+(x+2)^2=(10)^2$

$x^2+(x+2)(x+2)=100$

$x^2+x^2+4x+4=100$

$2x^2+4x-96=0$

$$2x^2+4x-96=0$$

Try and solve by factoring

$$2(x^2+2x-48)=0$$

$$2(x+8)(x-6)=0$$

∴ the roots are $x=-8,6$ but the length of the shorter side cannot be negative!

The length of the shorter side is 6m and the length of the longer side is $(6+2)$ 8m.

Action!

Application Problems
The Set-Up

Pg. 276
#13

3. The sum of the squares of two consecutive integers is 452. Find the integers.

Let x represent the smaller number.

∴ the larger number is x+1

squares

$x^2 + (x+1)^2 = 452$

sum — consecutive

$x^2 + x^2 + 2x + 1 = 452$

$2x^2 + 2x - 451 = 0$

Application Problems
The Set-Up

Pg. 283
#12

4. A photograph measuring 12 cm by 8 cm is to be surrounded by a mat before framing. The width of the mat is to be the same on all sides of the photograph.

The area of the mat is to equal the area of the photograph.

Find the width of the mat.

Application Problems
The Set-Up

Pg. 276
#13

5. Two numbers differ by 6. If the numbers are squared and then added, the result is 146. What are the numbers?

Application Problems
The Set-Up

Pg. 293
#7

6. The Sipapu Natural Bridge is defined by the equation $-0.04x^2 + 3.28x = 0$.
Find the horizontal distance, in metres, across this natural arc by solving the equation.

Application Problems
The Set-Up

Pg. 295

Modelling Math

7. The function $h = -5t^2 + 20t + 1$ models the height, h metres, of a baseball as a function of the time, t seconds, since it was hit. The ball hit the ground before a fielder could catch it.

a) How long was the baseball in the air?
b) For how many seconds was the height of the ball at least 16 m?

Application Problems
The Set-Up

Not in book.

8. A golf ball is hit a distance of 320 yards, reaching a maximum height of 256 yards.

a) After how many yards will the ball reach its maximum height?

b) Create a labelled sketch of the path of the ball including the vertex, y-intercept and x-intercepts.

c) Create an equation, **in vertex form**, for the flight of the ball.

Homework

Pg. 283-284
11, 14, 16, 19, 21

Pg. 293-294
4, 11

Two Line Calculator

Let's solve, with a two-line calculator using The Quadratic Formula.

$$x^2 + 6x + 8 = 0$$

NOTE: If you are asked for the **exact roots**, a two-line calculator may not work!

They typically throw up decimal numbers!

So don't be too lazy, use your pencil.

Besides, it's easy to make a mistake with all the brackets and junk.