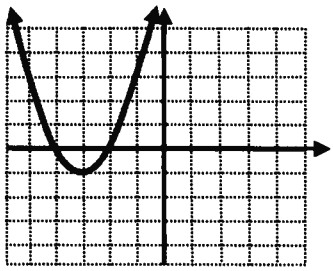
Factored Form of a Quadratic

- The factored form of a quadratic takes the form: $y = a(x-s)(x-t)$

i.e. $y = (x+2)(x+4)$



- In this form, the values of a, s and t have an effect on the shape and position of the parabola.

S and T
- They are the x-intercept(s) of a quadratic. They are also called the zeros, because they are the point(s) where $y = 0$.

A
- Determines the direction of opening.
  - Positive value: the parabola opens upwards
  - Negative value: opens downwards

Ex/ Examine the following parabolas, and determine:

a) Direction of opening.
b) The zeros.
c) The y-intercept.
d) The axis of symmetry.
e) The vertex.

if i) $y = (x+4)(x-2)$ (a, s, t)

a) Opens up (a is +1)

b) $(-4,0)$, $(2,0)$ * Since $(-4+4)=0$, $(2-2)=0$

c) $y = (0+4)(0-2)$
$= 4(-2)$
$= -8$ $(0,-8)$ * Point where $x = 0$

d) $x = \frac{-4+2}{2} = \frac{-2}{2} = -1$ * midpoint of zeros

e) $y = (-1+4)(-1-2)$
$= 3(-3)$
Vertex: $(-1,-9)$ * Use axis of symmetry in equation

ii) $y = -(x)(x-6)$

a) Opens down (a is -1)

b) $(0,0)$, $(6,0)$

c) $y = -(0)(0-6)$
$= -0(-6)$
$= 0$ $(0,0)$

d) $x = \frac{0+6}{2} = 3$

e) $y = -3(3-6)$
$= -3(-3)$
$= 9$ Vertex: (3,9

- When the value of a changes, it has another effect on the shape of a parabola besides the direction of opening.

Ex/ Examine the following quadratics and determine their zeros and vertex. Then make a sketch of each.

a) $y=(x+1)(x-3)$

a) Zeros: $(-1,0),(3,0)$

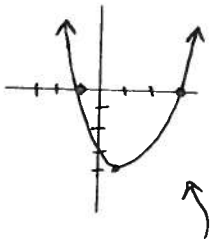
Axis: $x=\frac{-1+3}{2}=1$

$y=(1+1)(1-3)$

$=2(-2)$

$=-4$

Vertex $(1,-4)$



↑ $a=1$ (standard)

b) $y=5(x+1)(x-3)$

Zeros: $(-1,0),(3,0)$

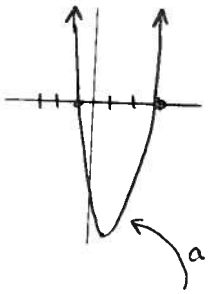
Axis: $x=1$

$y=5(1+1)(1-3)$

$=5(2)(-2)$

$=-20$

Vertex $(1,-20)$



$a=5$ (narrower)

c) $y=\frac{1}{10}(x+1)(x-3)$

Zeros: $(-1,0),(3,0)$

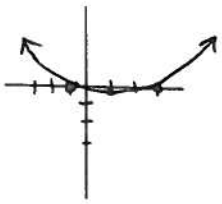
Axis: $x=1$

$y=\frac{1}{10}(1+1)(1-3)$

$=0.1(2)(-2)$

$=-0.4$

Vertex $(1,-0.4)$



$a=\frac{1}{10}$ (wider)

- When $a=1$ a parabola is standard sized.
- If $a>1$ the parabola is vertically stretched and it becomes narrower.
- If $0<a<1$ the parabola is vertically compressed and it becomes wider.

Ex/ Given $y=2(x+4)^2$ determine:

a) Direction of opening.
b) Size compared to normal.
c) The zeros.
d) The y-intercept.
e) The axis of symmetry.
f) The vertex.

a) opens up (a is positive)

b) narrower ($a>1$)

c) $y=2(x+4)^2$ → write it twice

$=2(x+4)(x+4)$

zeros: $(-4,0),(-4,0)$

* Really only 1 zero

d) $x=0$, $y=2(0+4)^2$

$=2(4)^2$

$=2(16)$

$=32$

$(0,32)$

e) $x=\frac{-4+(-4)}{2}=-4$

f) $y=2(-4+4)^2$

$=2(0)^2$

$=2(0)$

$=0$

Vertex $(-4,0)$

* Special case
Vertex = Zero
happens when
only 1 zero

Homework: Pg. 155 #'s: 1ab,4ace,8