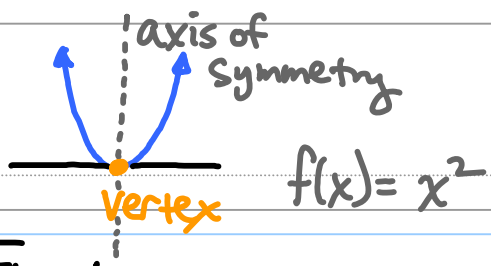
2/7 THU

2.2 Quadratic Functions



Standard Form of a Quadratic Function

$$f(x) = a(x-h)^2 + k, \quad a \neq 0$$

horiz translation: h ; vert translation: k

"vertex form"

- minimum @ vertex → if $a>0$, then ∪ opens up
- maximum @ vertex → if $a<0$, then ∩ opens down

vertex: (h,k)

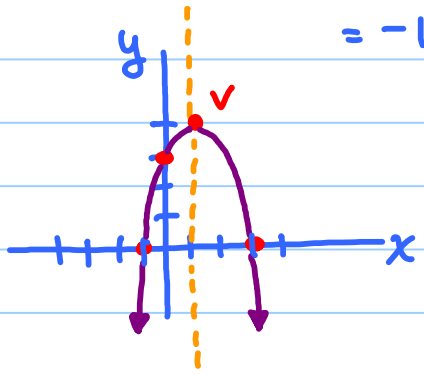
axis of symmetry: $x=h$

To graph a quadratic in $f(x)=a(x-h)^2+k$....

1) Does the parabola open up or down? → a
2) State the vertex. → (h,k)
3) Find x-intercepts. → $f(x)=0$ (set $y=0$) aka roots, zeros, solns
4) Find y-intercepts. → $f(0)$ (set $x=0$)
5) Plot the points

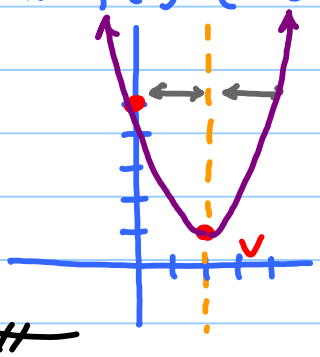
ex 1) Graph $f(x)=-(x-1)^2+4$

1) ∩ because $a<0$
2) $v(h,k) = (1,4)$ ... shift 1 right & 4 up
3) axis of sym: $x=h \rightarrow x=1$
4) x-int: $0=-(x-1)^2+4$
   $-4=-(x-1)^2$
   $4=(x-1)^2$
   $\pm\sqrt{4}=x-1$
   $1\pm\sqrt{4}=x$
   $1\pm2=x$
   $3,-1=x$
5) y-int: $f(0)=-(0-1)^2+4$
   $=-(-1)^2+4$
   $=-1+4=3$
6)



ex 2) Graph $f(x) = (x-2)^2 + 1$

1) ↑ $a>0$
2) $V(h,k) = (2,1)$
3) axis of sym: $x=2$
4) x-int: $0 = (x-2)^2+1$
$-1 = (x-2)^2$
$\sqrt{-1} = x-2$ → none
5) y-int: $f(0) = (0-2)^2+1 = 4+1 = 5$
6)



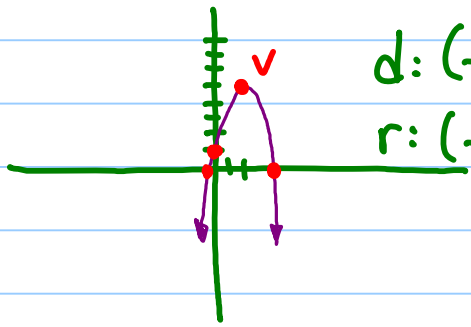
Graphing in the form $f(x) = ax^2+bx+c$

1) up or down? If $a>0$: ↑. If $a<0$: ↓
2) Find the vertex. $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$ ← subst x into the function
3) Find x-intercepts. $f(x)=0$
→ factor (ac, guess, $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$, etc....)
4) Find the y-intercept. $f(0)=c$ → $(0,c)$
5) Graph points

ex 3) Graph $f(x) = -x^2+4x+1$. State domain & range.

$a:-1 \quad b:4 \quad c:1$

1) ∩ : $a<0$
2) vertex: $x = \frac{-b}{2a} = \frac{-(4)}{2(-1)} = 2$ ← also axis of sym
Find the y: $f(2) = -(2)^2+4(2)+1$
$= -4+8+1 = 5$
∴ V: $(2,5)$
3) x-int: $0 = -x^2+4x+1$
* GC → EQUA → POLY → degree 2
$\frac{-(4) \pm \sqrt{(4)^2-4(-1)(1)}}{2(-1)} = \frac{-4 \pm \sqrt{16+4}}{-2}$
$= \frac{-4 \pm \sqrt{20}}{-2} \approx -0.24$ & 4.23
4) y-int: $f(0) = c = ①$: $(0,1)$
5) Graph:



d: $(-\infty, \infty)$
r: $(-\infty, 5]$

ex 4) $f(x) = 4x^2 - 16x + 1000$. Determine (w/o GC) whether the graph has a max or min. Find it. State domain & range.

→ Minimum : $a > 0$

→ $x = \frac{-b}{2a} = \frac{-(-16)}{2(4)} = \frac{16}{8} = 2$ (x-value)

$f(2) = 4(2)^2 - 16(2) + 1000 = 16 - 32 + 1000 = 984$

∴ Minimum: $(2, 984)$

→ d: $(-\infty, \infty)$

→ r: $[984, \infty)$

HW: p298, #1-8 all, 10-44 even