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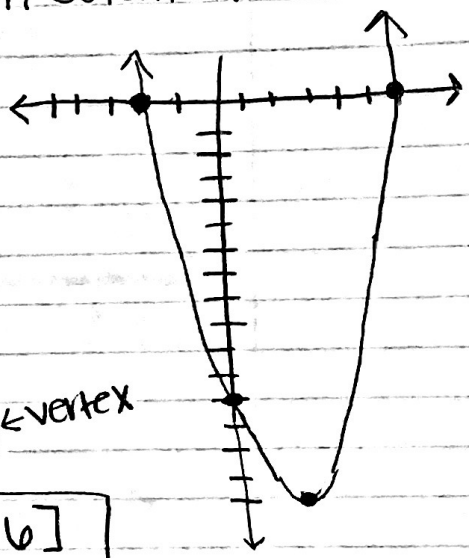
4.5 Inequalities w/ Quadratics

*if $f(x)=ax^2+bx+c$ then $f(x)>0$ → where it is above the x-axis

$f(x)<0$ → where it is below the x-axis

ex.1) solve $x^2-4x-12\leq 0$ and graph solution

① graph $f(x)=x^2-4x-12$



y-int: $f(0)=-12$

x-int: $x^2-4x-12=0$

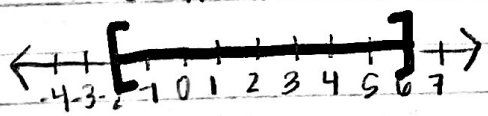
$(x-6)(x+2)=0$

$x=6$ or $x=-2$

vertex: $x=\frac{-b}{2a}=\frac{-(-4)}{2(1)}=2$

$f(2)=-16$ $(2,-16)$ ← vertex

so $x^2-4x-12\leq 0$ at $[-2,6]$



or $\{x \mid -2\leq x\leq 6\}$

ex.2) solve $2x^2<x+10$ & graph solution

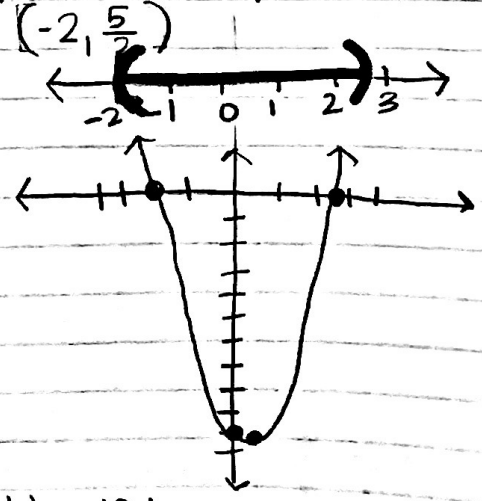
① move all to one side

$2x^2<x+10$

$-x-10 \quad -x-10$

$2x^2-x-10<0$

② graph $2x^2-x-10=f(x)$



y-int: $f(0)=-10$

x-int: $2x^2-x-10=0$

$(2x-5)(x+2)=0$

$x=\frac{5}{2}$ or $x=-2$

vertex: $x=\frac{-b}{2a}=\frac{-(1)}{2(2)}=\frac{1}{4}$ $f(\frac{1}{4})=-10.1$

$(\frac{1}{4},-10.1)$ ← vertex

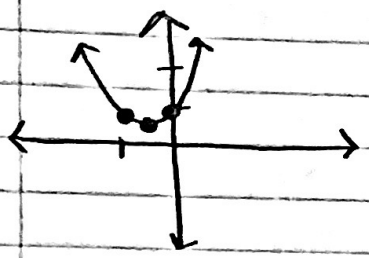
ex.3) $x^2+x+1>0$

graph $f(x)=x^2+x+1$

y-int: $f(0)=1$

vertex: $x=\frac{-b}{2a}=\frac{-1}{2(1)}=\frac{-1}{2}$

$f(-\frac{1}{2})=\frac{3}{4}$ } $(-\frac{1}{2},\frac{3}{4})$

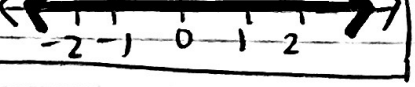


No x-int: (look at discriminant)

b^2-4ac

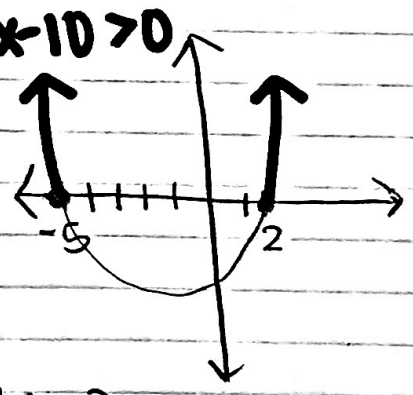
$1^2-4(1)(1)=1-4=-3$

since $b^2-4ac<0$ there are no x-int

$(-\infty,+\infty)$ 

*Shortcut!!

ex.4) $x^2+3x-10>0$



→ Find x-int : $0=x^2+3x-10$

$0=(x+5)(x-2)$

$x=-5 \quad x=2$

→ Find if parabola opens up or down?

$a>0$, opens up

→ Draw quick sketch

→ Write solution

$(-\infty,-5)\cup(2,\infty)$