C2 we complete the square
NOT to solve, but to turn
$f(x) = ax^2+bx+c$ into $a(x-h)^2+K$

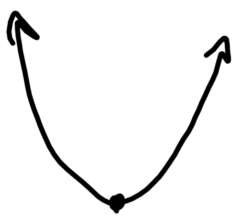
$f(x) = x^2-6x-7$

$= x^2-6x+3^2-9-7$

$= (x-3)^2-16$

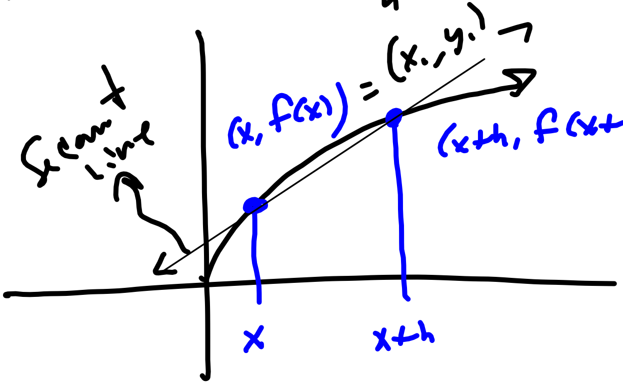
vertex $= (3,-16)$

They ain't no "= 0" heah.



(3,-16)

Nice test question. Draw pic. for difference quotient: $\frac{f(x+h)-f(x)}{h}$ $= m_{sec}$ = slope of the secant line.



$$m = \frac{f(x+h)-f(x)}{(x+h)-x} = \frac{f(x+h)-f(x)}{h}$$

$$f(x) = \sqrt{x} \Rightarrow \frac{f(x+h)-f(x)}{h}$$

$$= \frac{\sqrt{x+h}-\sqrt{x}}{h} = \left(\frac{\sqrt{x+h}-\sqrt{x}}{h}\right)\left(\frac{\sqrt{x+h}+\sqrt{x}}{\sqrt{x+h}+\sqrt{x}}\right)$$

$$= \frac{x+h-x}{h(\sqrt{x+h}+\sqrt{x})} = \frac{h}{h(\sqrt{x+h}+\sqrt{x})} = \boxed{\frac{1}{\sqrt{x+h}+\sqrt{x}}}$$

College Algebra stops

$(a-b)(a+b) = a^2-b^2$

For Bonus, Do some Calculus:

Let $h \to 0$!

$$\frac{1}{\sqrt{x+h}+\sqrt{x}} \xrightarrow{h \to 0} \frac{1}{\sqrt{x}+\sqrt{x}} = \boxed{\frac{1}{2\sqrt{x}}} = \underline{f'(x)}$$

Stop here for full bonus.

The Derivative!

The slope of $f(x) = \sqrt{x}$ is $f'(x) = \frac{1}{2\sqrt{x}}$

"f-prime of x"

$$f(x)=\sqrt{x+2} \Longrightarrow \frac{f(x+h)-f(x)}{h}$$

$$=\left(\frac{\overbrace{\sqrt{(x+h)+2}}^{a}-\overbrace{\sqrt{x+2}}^{b}}{h}\right)\left(\frac{\sqrt{x+h+2}+\sqrt{x+2}}{\sqrt{x+h+2}+\sqrt{x+2}}\right)$$

a^2 b^2

$x+h+2-x-2=h$

$$=\frac{x+h+2-(x+2)}{h\left(\sqrt{x+h+2}+\sqrt{x+2}\right)}=\frac{h}{h\left(\sqrt{x+h+2}+\sqrt{x+2}\right)}$$

$$=\boxed{\frac{1}{\sqrt{x+h+2}+\sqrt{x+2}}} \quad \xrightarrow{h\to 0} \quad \frac{1}{2\sqrt{x+2}}$$

Bonus

Full credit for 121.

"Take the limit as h approaches zero.