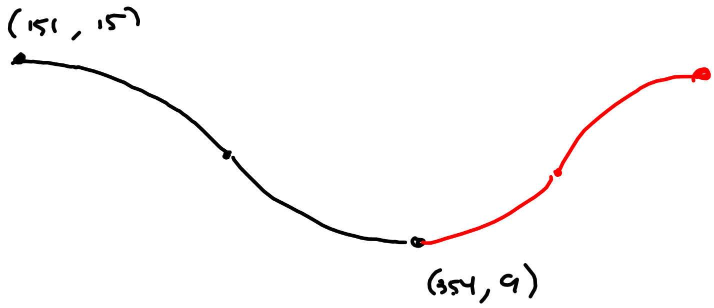
Trig functions are periodic and that adds a wrinkle. It also helps us model periodic stuff.

Length of sunlight hours is sinusoidal. On the summer solstice, the day is 15 hours

On the winter solstice, the daylight lasts for 9 hours. Model the # of hours of sunlight with a trig function.



Summer Solstice June 21st

winter Solstice December 21st

J	F	M	A	M	J	J	A	S	O	N	D
31	28	31	30	31	30	31	31	30	31	30	31

130 + 21 = 151 ⟶ 6/21

t = 151 on 6/21

354 → 12/21

$\begin{array}{r} 333 \\ 21 \\ \hline 354 \end{array}$

t = # of the day of year.

(151, 15), (354, 9)

HIGH LOW

Cosine starts @ its high point.

Period = 365 days.

$a\cos(b(x-c)) + d$

Amplitude = 3

midline. $y = 12$ hours of daylight

$\cos(bt)$

Period is 365

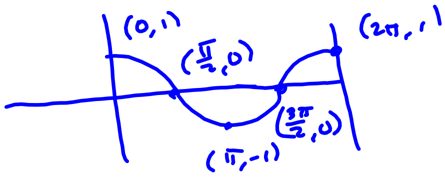
$bt = 2\pi$ when $t = 365$

$b = \frac{2\pi}{365}$

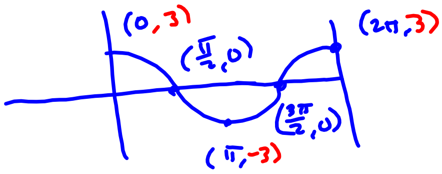
Start @ high point: $t = 151 = c$

$$\boxed{3\cos\left(\frac{2\pi}{365}(t-151)\right) + 12}$$

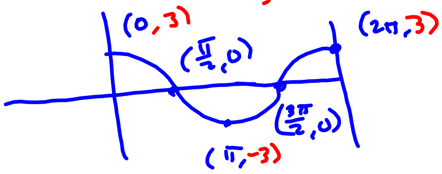
$\cos(t)$



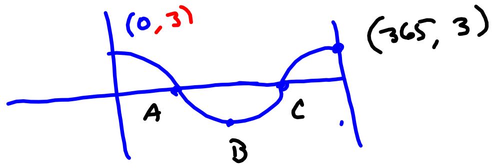
$3\cos(t)$



$3\cos\left(\frac{2\pi}{365}t\right)$



$t \mapsto \frac{365}{2\pi}t$



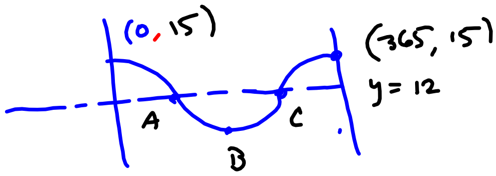
$A = \left(\frac{365}{4}, 0\right)$

$B = \left(\frac{365}{2}, -3\right)$

$C = \left(\frac{3 \cdot 365}{4}, 0\right)$

$\frac{365}{2\pi} \cdot \frac{\pi}{2}$

$= \frac{365}{4}$



$A = \left(\frac{365}{4}, 12\right)$

$B = \left(\frac{365}{2}, 9\right)$

$C = \left(\frac{3 \cdot 365}{4}, 12\right)$

$f \circ g$ = "f composed with g"

$(f \circ g)(x)$ = "f composed with g of x."

$= f(g(x))$ = function of a function.

$f(x) = x^2$

$g(x) = x+h$

$(f \circ g)(x) = f(x+h) = (x+h)^2$

$f(x) = \frac{1}{x-3}$, $g(x) = \sqrt{x-8}$, $h(x) = x^2 - 2x$

$D(f) = \mathbb{R} \setminus \{3\}$

$= (-\infty, 3) \cup (3, \infty)$

$= \{x \mid x \neq 3\}$

$D(g)$: Need $x - 8 \geq 0$

$x \geq 8$

$D(g) = [8, \infty) = \{x \mid x \geq 8\}$

$D(h) = \mathbb{R}$

$(f \circ g)(x) = \frac{1}{g(x) - 3} = \frac{1}{\sqrt{x-8} - 3}$

D: Need $x - 8 \geq 0$

and

$\sqrt{x-8} - 3 \neq 0$

$\sqrt{x-8} \neq 3$

$x - 8 \neq 3^2 = 9$

$x \neq 17$

$A = \{x \mid x \geq 8\}$, $B = \{x / x \neq 17\}$

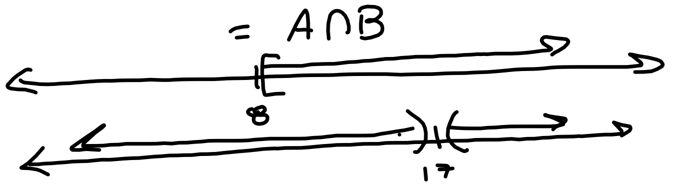
$D(f \circ g) = \{x \mid x \in D(g) \text{ and } g(x) \in D(f)\}$

$= \{x \mid x \geq 8 \text{ and } x \neq 17\}$

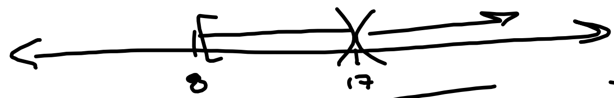
$A \cap B = \{x \mid x \in A \text{ and } x \in B\}$

$= \{x \mid x \in A \cap B\}$

$= A \cap B$



AND

$=$ 

$= \boxed{[8,17) \cup (17,\infty) = D(f \circ g)}$

$x \geq 8$ and $x \neq 17$

$$(f\circ h)(x) = \frac{1}{h(x)-3}$$

$$(g\circ h)(x) = g(h(x)) = \sqrt{h(x)-8}$$

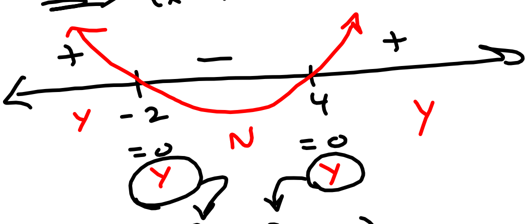
$$= \sqrt{x^2-2x-8}$$

$$\{x \mid x\in D(h) \text{ and } h(x)\in D(g)\}$$

x^2+

Need $x^2-2x-8 \ge 0$

$\Rightarrow (x-4)(x+2) \ge 0$



$$= (-\infty,-2] \cup [4,\infty)$$

Section 1.4: Way too many secant slope calculations:

$$f(x)=\frac{2}{6-x}$$

$$m(x)=\frac{(f(x)-f(7))}{x-7}$$

$m(6.9)$

$= 2.22222222222$

$m(6.99)$

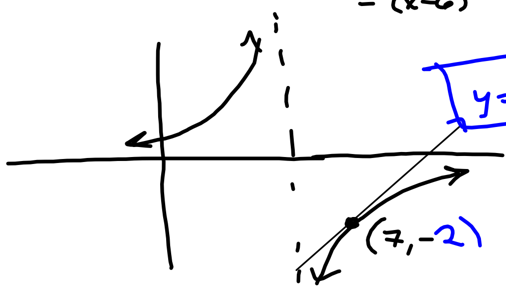
$= 2.0202020202$

$m(6.999)$

$= 2.002002002$

1.4 #2. Trying to arrive at the slope of

2/(6 - x) @ $x = 7$ $= \frac{2}{-(x-6)}$



$\boxed{y=2(x-7)-2}$

$= m(x-x_1)+y_1$

$x=6$

$\boxed{y=2(x-x_1)+y_1}$

Less work than

$y=2x-16.$ $y=mx+b$

Attachments

260121.jpg

260121-excel.xlsx