Section 1.5 and 1.6, today? We'll see how far we get.

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

$af(b(x-c))+d$ Transforming a basic function...

Odd-vs-even functions

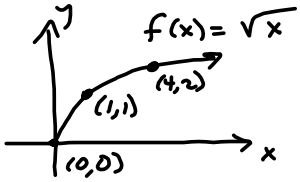
Trig functions are periodic.

Questions?

Graph. Label key points.

$3\sqrt{5x+20}+10$

Basic $\sqrt{x}$ graph:



$af(x)$ $y \mapsto ay$ } stretch/shrink.

$f(bx)$ $x \mapsto \frac{1}{b}x$ }

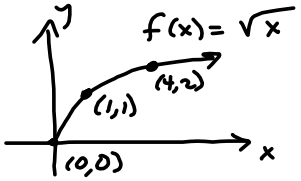
$f(x-c)$ $x \mapsto x+c$ } shifts

$f(x)+d$ $y \mapsto y+d$ }

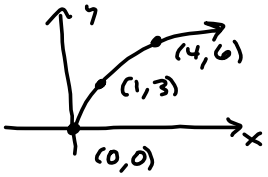
1. $af(x)$
2. $af(bx)$
3. $af(b(x-c))$
4. $af(b(x-c))+d$

$g(x)=3\sqrt{5x+20}+10$

0. $f(x)=\sqrt{x}$



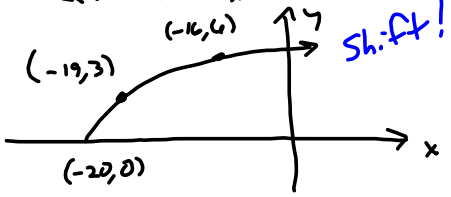
1. $3f(x)=3\sqrt{x}$ $y \mapsto 3y$



2. METHOD 1
(Easier for beginners. Worse for experts)

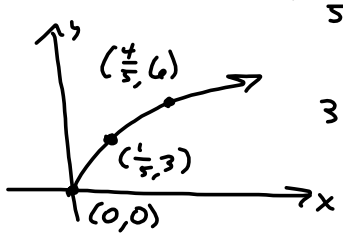
$3f(x+20)=3\sqrt{x+20}$

Left 20 $x \mapsto x-20$



3. METHOD 2

$3f(5x)$ $x \mapsto \frac{1}{5}x$



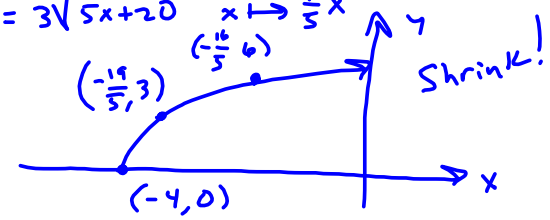
$3\sqrt{5x}$ Shrink

(3) METHOD 1

$af(bx+c)$

Replace x by bx

$= 3\sqrt{5x+20}$ $\quad x \mapsto \frac{1}{5}x$



Shrink!

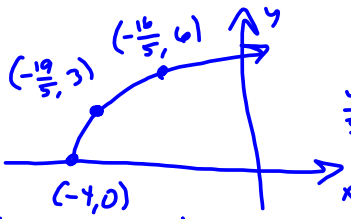
(3) METHOD 2

$af(b(x-c)) = 3f(5(x+4))$

$5x+20 = 5(x+4)$

$3\sqrt{5(x+4)}$ LEFT 4

Shift!



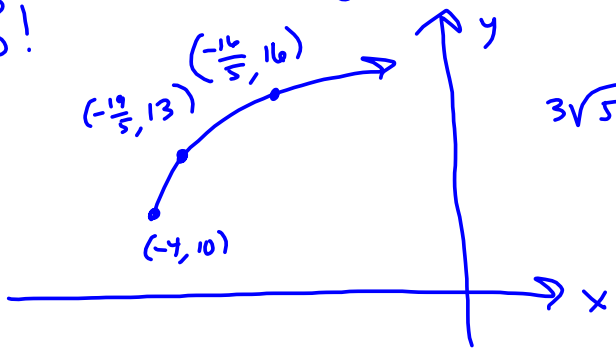
$\frac{1}{5} - 4 = \frac{1-20}{5} = -\frac{19}{5}$

$\frac{4}{5} - \frac{20}{5} = -\frac{16}{5}$

(4) $af(bx+c)+d$ or $af(b(x-c))+d$, depending

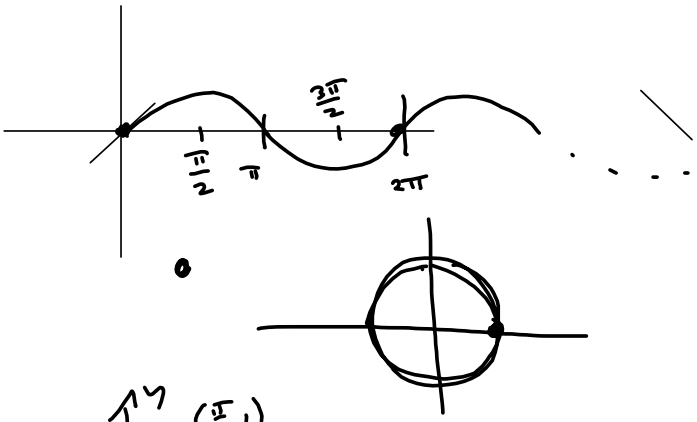
= original $g(x)$. up 10 from previous.

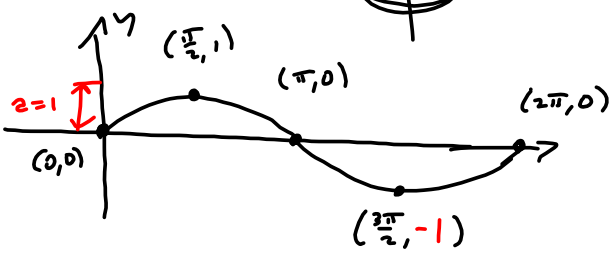
UP 10!



$3\sqrt{5(x+4)} + 10$

Basic Graph of Sine :





$y = \sin(x)$.
one period.

$y = a\sin(b(x-c)) + d$

Amplitude
$\frac{\text{HIGH} - \text{LOW}}{2}$

Period of $\sin(*)$ is
$* = 2\pi$
$bx = * = 2\pi$ → I remember this.

$x = \frac{2\pi}{b}$ = period of $\sin(bx)$.

$a\sin(b(x-c)) + d$ → $y = d$ is midline.

starting point.

$20\sin\left(\frac{\pi}{8}x - \frac{7\pi}{8}\right) - 9$

$= 20\sin\left(\frac{\pi}{8}(x-7)\right) - 9$

Amp $= 2 = 20$

$y = -9$ = midline

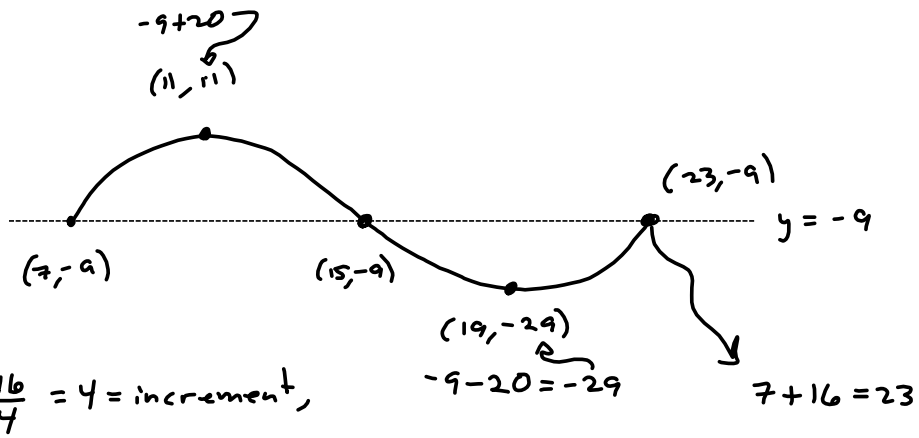
$\frac{\pi}{8}(x-7)$

$\frac{\frac{7\pi}{8}}{\frac{\pi}{8}} = \frac{7\pi}{8}\cdot\frac{8}{\pi} = 7$

$\frac{\pi}{8}x = 2\pi$

$x = \frac{2\pi}{\frac{\pi}{8}} = \frac{2\pi}{1}\cdot\frac{8}{\pi} =$ **16 = Period**

START AT $x = 7$ (from $x-7$ inside)



$\frac{16}{4} = 4$ = increment,

or just halve the distances

$7+4=11$ OR $\frac{7+23}{2} = 15$

$11+4=15$

$15+4=19$

$19+4=23$

§1.5 #30

Build cosine to fit the data.

All we need is high & low

(1, 57.1) LOW

(7, 104.1)

PERIOD = ?

Let t = # of the month, starting with January = 1.

PERIOD = 12 months (x-axis)

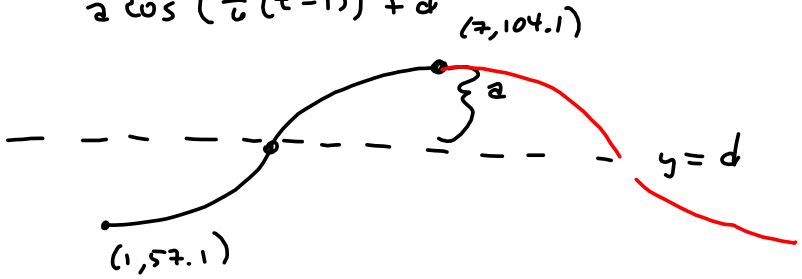
$bx = 2\pi$, when $x = 12$

$12b = 2\pi$, $b > 0$

$b = \frac{2\pi}{12} = \frac{\pi}{6}$ $\Rightarrow$ $a\cos\left(\frac{\pi}{6}(x-c)\right)+d$.

January = 1 = t = start, so:

$a\cos\left(\frac{\pi}{6}(t-1)\right)+d$



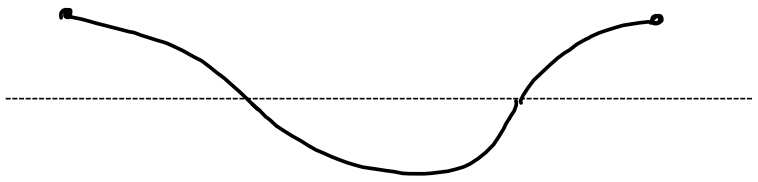
Midline: $\frac{57.1+104.1}{2} = \frac{161.2}{2} = 80.6$

$a\cos\left(\frac{\pi}{6}(t-1)\right)+80.6$

Amplitude: $\frac{104.1-57.1}{2} = \frac{47.0}{2} = 23.5$

So, our function is $y = 23.5\cos\left(\frac{\pi}{6}(t-1)\right)+80.6$

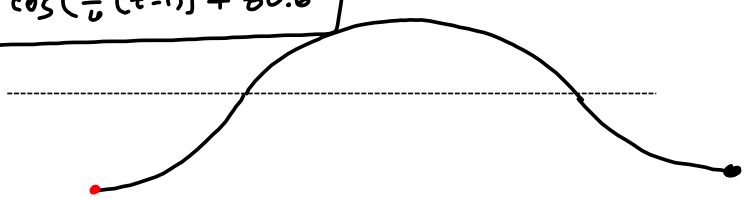
Upside-Down!



To achieve this:

Multiply by -1!

$y = -23.5\cos\left(\frac{\pi}{6}(t-1)\right)+80.6$

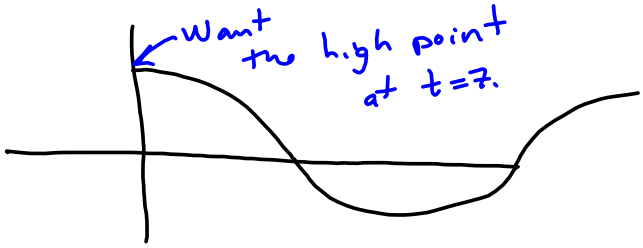


Book Answer:

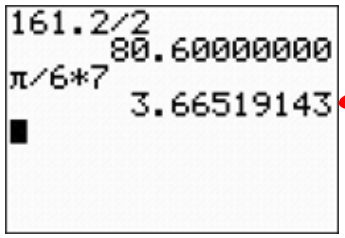
$23.5\cos\left(\frac{\pi t}{6} - 3.67\right) + 80.6$!?

What'd they do?

They took a right-side-up cosine & shifted it!



$23.5\cos\left(\frac{\pi}{6}(t-7)\right) + 80.6$ will put high point at $t=7$



There's the book's 3.67.