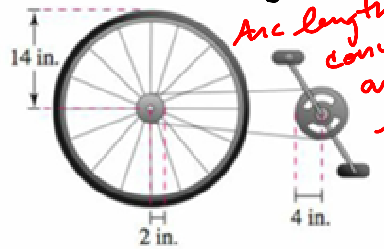
The radii of the pedal sprocket, the wheel sprocket, and the wheel of the bicycle in the figure are 4 inches, 2 inches, and 14 inches, respectively. A cyclist is pedaling at a rate of 1 revolution per second.



$s = r\theta$ Arc length convert angle to linear distance

(a) Find the speed of the bicycle in feet per second and miles per hour.

(b) Use your result from part (a) to write a function for the distance d (in miles) a cyclist travels in

$$\left(\frac{1.5 \cancel{\text{revs front}}}{1 \text{ sec}}\right)\left(\frac{2 \cancel{\text{revs rear}}}{1 \cancel{\text{rev front}}}\right)\left(\frac{2\pi \text{ rad}}{1 \cancel{\text{rev rear}}}\right)\cdot$$

$$(14 \text{ in})\left(\frac{1 \text{ foot}}{12 \text{ in}}\right)$$

(a) $(1.5)(2)(2\pi)(14)\left(\frac{1}{12}\right)$ ft/sec

$$= \boxed{7\pi \text{ ft/s}}$$

60 mph = 88 ft/sec

$\dfrac{4 \text{ in front}}{2 \text{ in rear}}$ means $\dfrac{2 \text{ revs rear}}{1 \text{ rev front}}$

(b) Use your result from part (a) to write a function for the distance d (in miles) a cyclist travels in terms of the number n of revolutions of the pedal sprocket.

Let n = # of revs

$$\frac{7}{1.5} = \frac{7}{\frac{3}{2}} = \left(\frac{14}{3} \text{ ft}\right)$$

$$\theta$$

$$(n \text{ revs front})\left(\frac{2 \text{ revs rear}}{1 \text{ rev front}}\right)\left(\frac{2\pi \text{ rad}}{1 \text{ rev rear}}\right)\cdot$$

$$(14 \text{ in})\left(\frac{1 \text{ ft}}{12 \text{ in}}\right)\left(\frac{1 \text{ mi}}{5280 \text{ ft}}\right)$$

$$\boxed{\frac{(4\pi)(14)}{(12)(5280)} n}$$ linear in n.

(c) Write a function for the distance d (in miles) a cyclist travels in terms of the time t (in seconds). Compare this function with the function from part (b).

(b) $\approx .000883838384\pi\, n$

(c) Part (a) gives ft/s (rate)

dist = rate · time.

$$= \left(7\pi \text{ ft/s}\right)\left(\frac{1 \text{ mile}}{5280 \text{ ft}}\right) t$$

where t = time, in seconds.

$$\boxed{\approx .00132576\pi\, t \text{ mi}}$$

Don't forget t!

Also linear.

```
1.5*4*14/12
          7.00000000
4*100*12/5280
        8.83838384E-4
```

```
1.5*4*14/12
          7.00000000
4*14/12/5280
        8.83838384E-4
7/5280
           .00132576
```

1.5 #69

69. $y = \cos\left(2\pi x - \frac{\pi}{2}\right) + 1$ $= \cos\left(2\pi\left(x - \frac{1}{4}\right)\right) + 1$

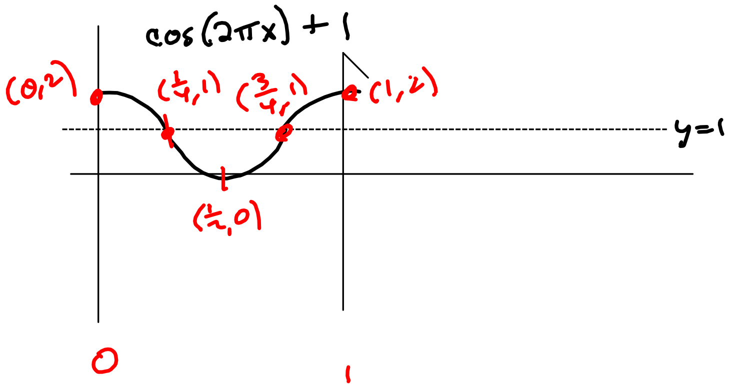
$y=1$ midline.

$2\pi x = 2\pi$ when $x = 1 = T$ $\qquad \frac{\frac{\pi}{2}}{2\pi} = \frac{\pi}{2} \cdot \frac{1}{2\pi} = \frac{1}{4}$

Amplitude 1 $\cos(\sim) \Rightarrow$

$x - \frac{1}{4}$ says shift right $\frac{1}{4}$

$\cos(2\pi x) + 1$



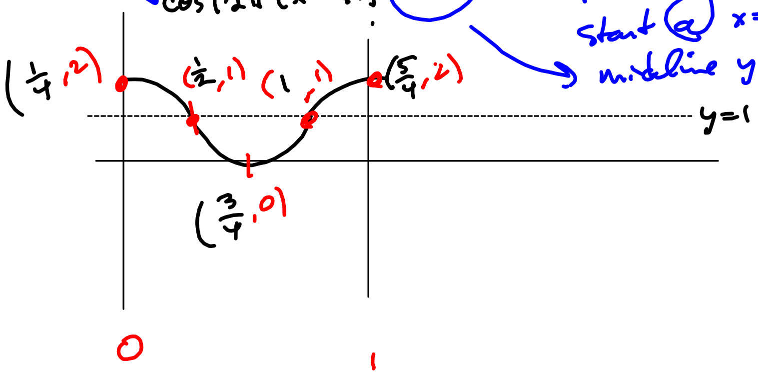
$\cos\left(2\pi\left(x - \frac{1}{4}\right)\right) + 1$

a=1

T=1 = period from "$2\pi x$"

start @ $x = \frac{1}{4}$

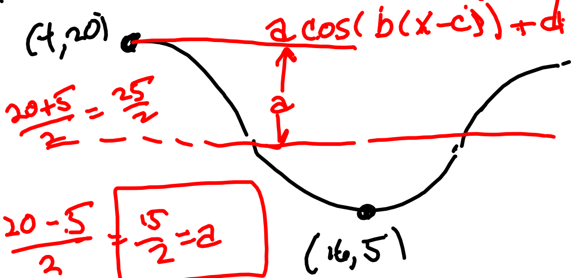
midline $y=1$



High Tide @ 4am of 20 ft

Low " @ 4pm of 5 ft

Model the Tide as a function of hours after midnight



$y = \frac{20+5}{2} = \frac{25}{2}$

$T = 24$ hrs

$bx = 2\pi$ when $x = 24$

$24b = 2\pi$

$\boxed{b = \frac{2\pi}{24} = \frac{\pi}{12}}$

$\boxed{d = \frac{25}{2}}$

$a = \frac{20-5}{2} = \boxed{\frac{15}{2} = a}$

Start @ $\boxed{x = 4 = c}$

$$y = \frac{15}{2}\cos\left(\frac{\pi}{12}(x-4)\right) + \frac{25}{2}$$

$\boxed{x = \text{\# of hours after midnight}}$

Find the cube roots of $8(\cos\frac{7\pi}{6} + i\sin\frac{7\pi}{6})$

$z=\sqrt[3]{8}$

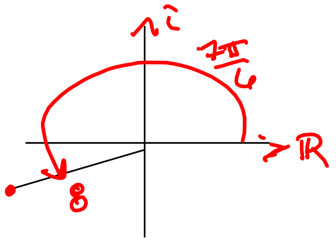
$r^{\frac{1}{n}}\left(\cos\left(\frac{\theta+2k\pi}{n}\right) + i\sin\left(\frac{\theta+2k\pi}{n}\right)\right)$

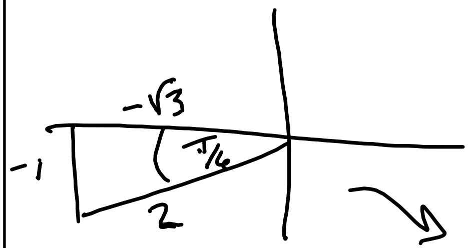
$2\left(\cos\left(\frac{7\pi}{18}\right) + i\sin\left(\frac{7\pi}{18}\right)\right)$

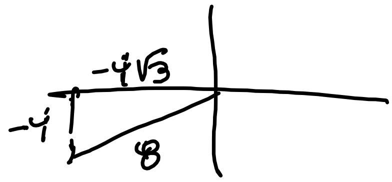
Increment: $\frac{2\pi}{3} = \frac{12\pi}{18}$

$2\left(\cos\left(\frac{19\pi}{18}\right) + i\sin\left(\frac{19\pi}{18}\right)\right)$,

$2\left(\cos\frac{31\pi}{18} + i\sin\left(\frac{31\pi}{18}\right)\right)$







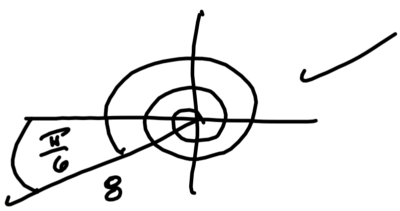
$z = -4\sqrt{3} - 4i$

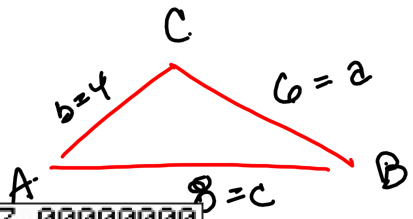
$$\left(2\left(\cos\left(\frac{31\pi}{18}\right) + i\sin\left(\frac{31\pi}{18}\right)\right)\right)^3$$

Cube that

$$= 8\left(\cos\left(\frac{31\pi}{6}\right) + i\sin\left(\frac{31\pi}{6}\right)\right)$$

$$\frac{31\pi}{6} = \frac{30\pi}{6} + \frac{\pi}{6} = 5\pi + \frac{\pi}{6}$$






```
     7.00000000
4*14/12/5280
  8.83838384E-4
7/5280
       .00132576
cos⁻¹(11/16)
    46.56746344
```

```
    46.56746344
cos⁻¹(7/8)
    28.95502437
cos⁻¹(11/16)+Ans
    75.52248781
Ans-180
   -104.4775122
```

Solve the triangle

$a^2=b^2+c^2-2bc\cos A$

$2bc\cos A = b^2+c^2-a^2$

$\cos A = \frac{b^2+c^2-a^2}{2bc}$

$= \frac{4^2+8^2-6^2}{2(4)(8)} = \frac{16+64-36}{64} = \frac{44}{64} = \frac{11}{16}$

$\approx 46.56746344^\circ$

$\cos B = \frac{a^2+c^2-b^2}{2ac} = \frac{6^2+8^2-4^2}{2(6)(8)}$

$= \frac{36+64-16}{96} = \frac{84}{96} = \frac{42}{48} = \frac{21}{24} = \frac{7}{8}$

$B = \cos^{-1}\left(\frac{7}{8}\right) \approx 28.95502437^\circ$

$C = 180^\circ - B - A \approx 104.4775122^\circ$

```
    28.95502437
cos⁻¹(11/16)+Ans
    75.52248781
Ans-180
   -104.4775122
46.57+28.96-180
   -104.4700000
```

$A \approx 46.57^\circ$

$B \approx 28.96^\circ$

$C \approx 104.48^\circ$

$\}$ 104.47° if I use rounded #s in calculation of C. That would be bad.