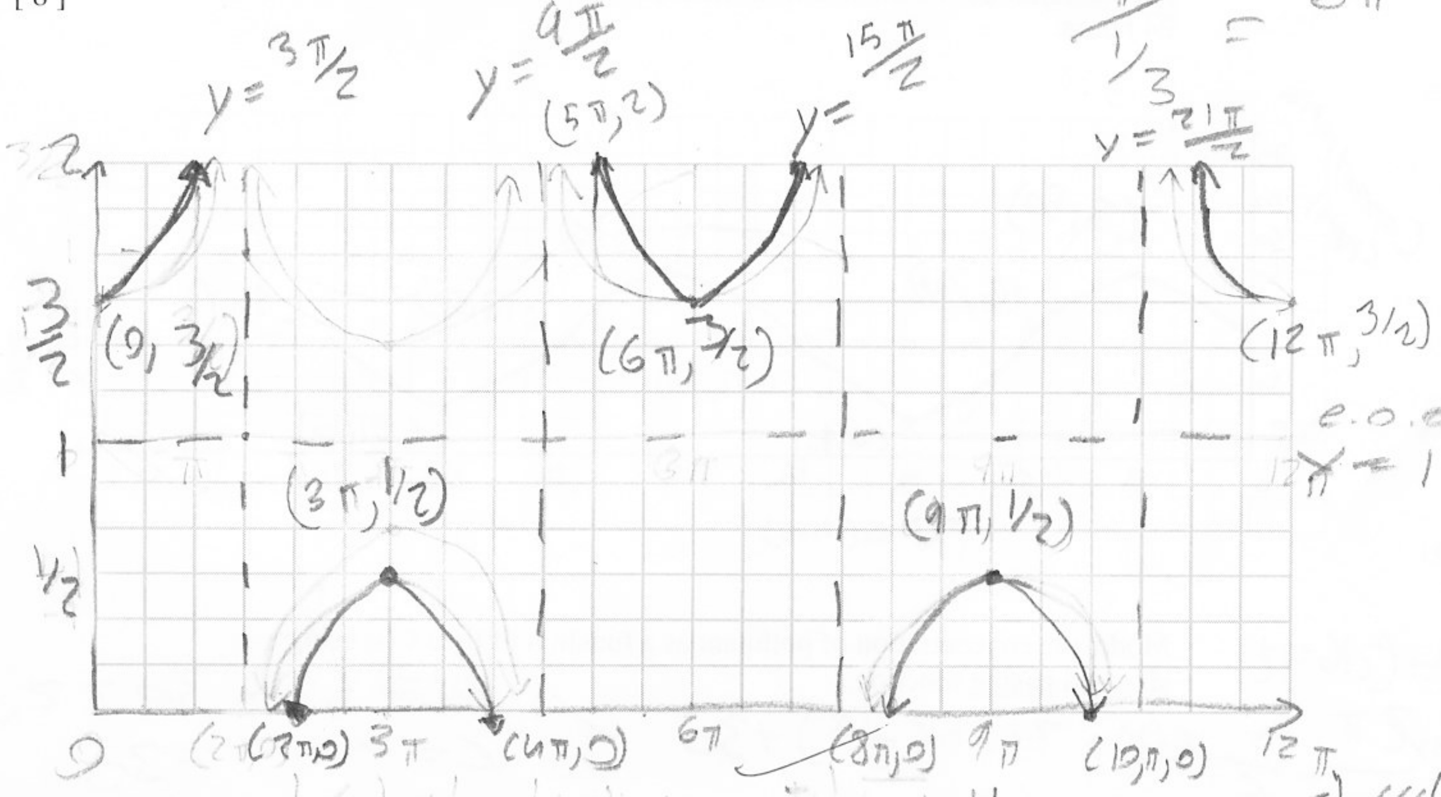
19. Neatly sketch **two cycles** of the graph of $y = -\frac{1}{2}\csc\left[\frac{1}{3}x - \frac{1}{2}\pi\right] + 1$. Clearly label the key values of this function, including any asymptotes, local extrema or zeros.

[8]

$\frac{2\pi}{1/3} = 6\pi$



$0 = -\frac{1}{2}(\sin(\frac{1}{3}x - \frac{1}{2}\pi)) + 1$ $= \frac{1}{2\sin} - 1) + 1$ $\frac{1}{2} + 1$

State the **general** expressions for: a) local minimals: b) all asymptotes:

a) local minimals at $6k\pi$ b) asymptotes at $3k\pi + \frac{3\pi}{2}$

$-0 = -\frac{1}{2}\csc(\frac{1}{3}x$

$2 = \frac{1}{\sin(\frac{1}{3}x - \frac{1}{2}}$

$\frac{1}{2} = \sin(\frac{1}{3}x$

$\frac{1}{6}\pi = \frac{1}{3}x - \frac{1}{2}$

$\frac{2\pi}{3} = \frac{1}{3}x$

$x = 2\pi$

Zeroes at 2π

COMMUNICATION

20. Explain if $\sin(\frac{1}{2})$ is the same as $\sin^{-1}(\frac{1}{2})$.

[2] These are not the same $\sin(1/2)$ finds the trigonometric ratio of sine at 1/2 a radian while $\sin^{-1}(1/2)$ is saying find the angle in radians given the trigonometric ratio. $\sin^{-1}(1/2)$ gives you $30°$ or $1/6\pi$ because that is what the sine trigonometric ratio of 1/2 applys too, $\sin(1/2)$ is some meaningless decimal number (0.47942...) as it is attempting to find the ratio at the angle

$\frac{1}{2} = \sin x$ $\sin^{-1}(\frac{1}{2}) = x = \frac{1}{6}\pi$

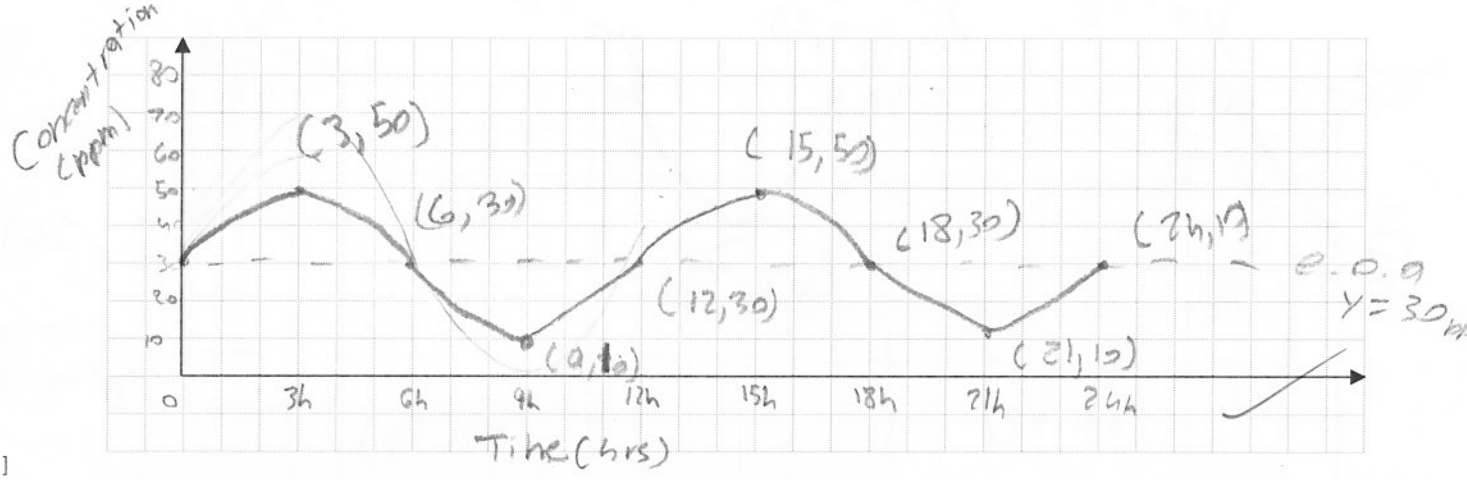
$\sin 1/2 = x$ $\sin 1/2 = 0.479$

$\sin^{-1}(1/2) \neq \sin(1/2)$

per million) and the minimum concentration was 10 ppm. The time between the maximum and minimum concentrations was 6 hours.

$e.o.a = \frac{50+10}{2} = 30$

a) Assuming the concentration of carbon monoxide was 30 ppm at t = 0 and ~~increasing,~~ sketch the concentration of pollutant as a function of time for 24 hours.



[3]

$P = (2)6 = 12$

b) Model the concentration of pollutant as a function of time C(t) using a **sine** and **cosine** function.

[5]

$k = \frac{2\pi}{12} = \frac{\pi}{6}$ $\quad C(t) = 20\sin\left(\frac{\pi}{6}x\right) + 30$

$|a| = 50 - 30 = 20$

$c = e.o.a = 30$

$C(t) = -20\cos\left(\frac{\pi}{6}(x+3)\right) + 30$

C(t) is concentration of time

c) Using one of your equations, determine the concentration of carbon monoxide in ppm at t = 5 hours.

[1]

$C(5) = 20\sin\left(\frac{\pi}{6}(5)\right) + 30$

$= 20\sin\left(\frac{5\pi}{6}\right) + 30$

$= 20(\frac{1}{2}) + 30 = 10 + 30 = 40$

18. The **height (in metres)** above the ground of a particular seat on a Ferris wheel as a function of the **time (in minutes)** is given by the function $h(t) = -12\cos\left[\frac{\pi}{2}t\right] + 13$

a. What is the maximum and minimum height of the seat above the ground?

$max = e.o.a + |a|$
$= 13 + |-12| = 25$

$min = e.o.a - |a|$
$= 13 - |-12|$
$= 1$

b. What is the **radius** of the wheel?

$radius = |a|$
$= 12$

c. How long does it take the wheel to make one complete revolution?

$k = \frac{\pi}{2}$

$P = \frac{2\pi}{(\frac{\pi}{2})} = \frac{2\pi}{1} \cdot \frac{2}{\pi} = 4$

So it takes 4 minutes to complete one revolution

d. Determine a new equation of the height of the seat above the ground after t minutes if one rotation takes 30 seconds.

[6]

$P = 30sec = \frac{1}{2}$ minute(s)