AB. Q100. LESSON 1 GRAPH BLUE 2

A1. $D: \{x \mid -9 \le x \le 9\}$

A2. $D: \{y \mid -2.5 \le y \le 7\}$

B1. f is continuous for all x.

B2. NOT APPLICABLE

C1. STAND DEFN: f is increasing on $[-3.5, 1] \cup [4.25, 9]$ b/c the slope of f is positive on $(-3.5, 1) \cup (4.25, 9)$

CONCEPT DEFN: f is increasing on $(-3.5, 1) \cup (4.25, 9)$ b/c the slope of f is positive on this interval.

C2. STAND DEFN: f is decreasing on $[-9, -3.5] \cup [1, 4.25]$ b/c the slope of f is negative on $(-9, -3.5) \cup (1, 4.25)$

D1. f has a local max at $x = 1$ because f is continuous and
* the slope of f goes from positive to negative at $x = 1$

D2. f has a local min at $x = -3.5$ and $x = 4.25$ at these x-values f is continuous and the slope of goes from negative to positive.

* Endpoints WERE NOT CONSIDERED HERE BECAUSE THE QUESTION ELIMINATED THEM WHEN ASKED FOR LOCAL EXTREMES on open interval $-9 < x < 9$

NO EQUAL HERE

E1. ESTIMATION: f is concave up on $(-5,-1.5) \cup (3.2, 5.75)$ because the slope of f is increasing on this interval.

E2. Estimation: f is concave down on $(-9,-5) \cup (-1.5, 3.2) \cup (5.75, 9)$ because the slope of f is decreasing on this interval.

F1. Ave slope on $[-9,9]$ $= \dfrac{f(9)-f(-9)}{9-(-9)} = \dfrac{7-5}{18} = \dfrac{2}{18} = \dfrac{1}{9}$

F2. Ave $f'(x)$ on $[0,7]$ $= \dfrac{f(7)-f(0)}{7-0} = \dfrac{5-2.7}{7} = \dfrac{2.3}{7}$

means slope

G1. Slope at $x=-5$ $\approx \dfrac{-2.5-3}{-3.5-(-6)} = \dfrac{-5.5}{2.5} = -2.2$

Average on small neighborhood

G2. $f'(7) \approx \dfrac{f(9)-f(5.5)}{9-5.5} = \dfrac{7-0}{9-5.5} = \dfrac{7}{3.5} = 2$

Ave. on small neighbor

G3. $\left.\dfrac{dy}{dx}\right|_{x=-6} \approx \dfrac{0-5}{-5-(-9)} = \dfrac{-5}{4}$

Ave small neigh.

G4. $f'(-3.5) = 0$ for we know this is a vertex and therefore a slope of zero

G5. $f'(9)$ ... since we do not have a point to the right of $x=9$ ... we will use this endpoint together with the coordinate to its left for an estimation

$$f'(9) \approx \frac{f(9)-f(7)}{9-7} = \frac{7-5}{9-7} = \frac{2}{2} = 1$$

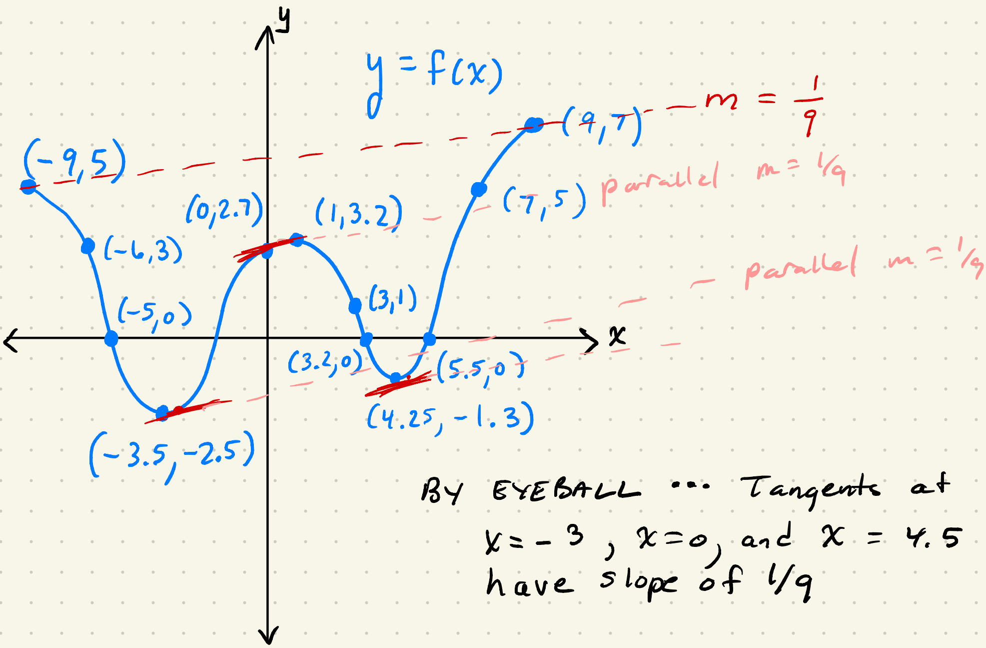
* endpoints get special considerations! :)

H. f has a horizontal tangent (slope zero) at $x = -3.5$, $x = 1$, and $x = 4.25$

I. NOT APPLICABLE. WE KNOW f is smooth and there are not vertical tangents.

J. M.V.T APPLIES BECause f is continuous on $[-9,9]$ and f has a slope everywhere on $(-9,9)$.

$$\underset{[-9,9]}{\text{Ave rate } \Delta} = \frac{1}{9}$$



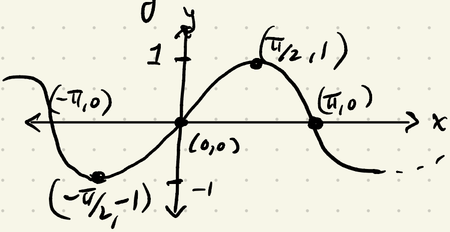
BY EYEBALL ... Tangents at $x = -3$, $x = 0$, and $x = 4.5$ have slope of $1/9$

K. $y - y_1 = m(x - x_1)$ or $y - f(0) = f'(0)(x - 0)$

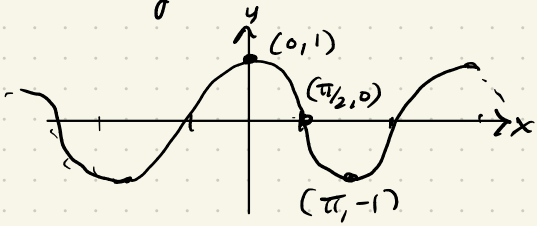
$$\boxed{y - 2.7 = \frac{1}{9}(x - 0)}$$

BASIC ESSENTIALS CATEGORY I

1. $y = \sin x$

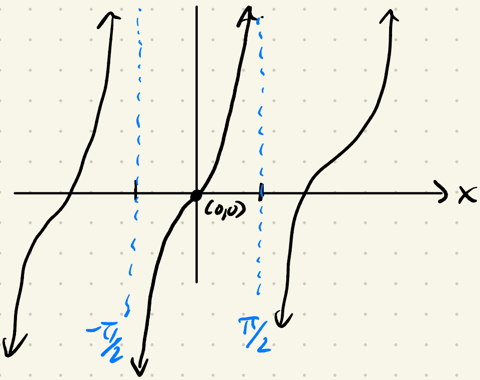


2. $y = \cos x$

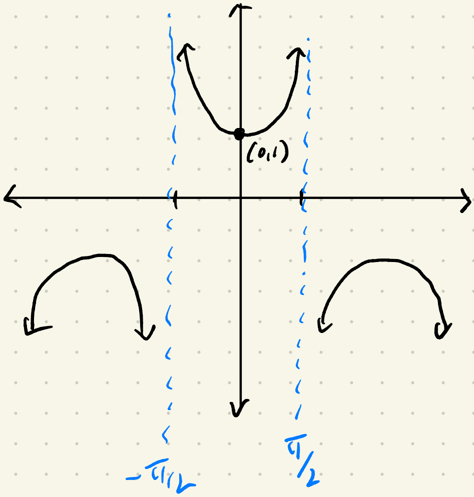


... $\cos(0) = 1$

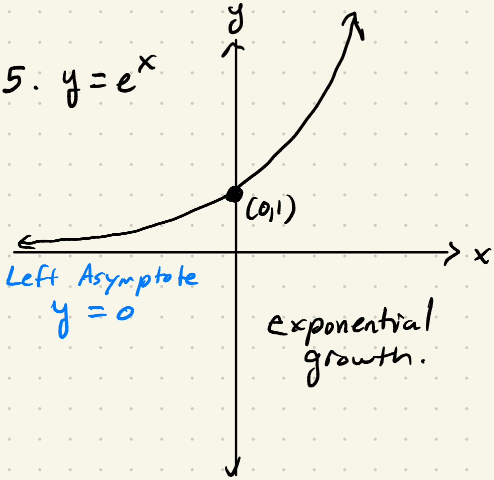
3. $y = \tan x$



4. $y = \sec x$



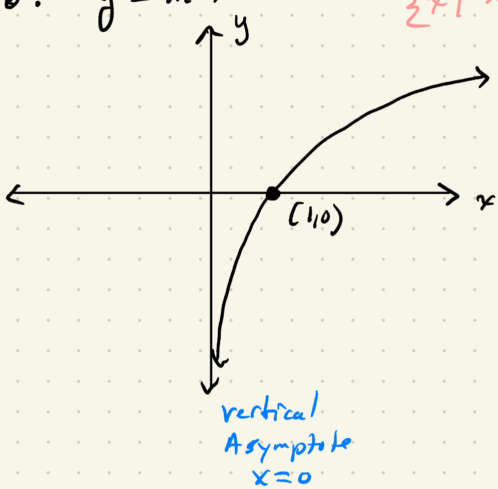
5. $y = e^x$



exponential growth.

6. $y = \ln x$

... Domain $\{x \mid x > 0\}$



BASIC ESSENTIALS : CATEGORY II

1. $\sin(5\pi/6) = \boxed{\frac{1}{2}}$
2. $\cos(11\pi/6) = \boxed{\frac{\sqrt{3}}{2}}$
3. $\tan(4\pi/3) = \frac{\sin(4\pi/3)}{\cos(4\pi/3)} = \frac{-\frac{\sqrt{3}}{2}}{-\frac{1}{2}} = \boxed{+\sqrt{3}}$
4. $\sec(2\pi/3) = \frac{1}{\cos(2\pi/3)} = \frac{1}{-\frac{1}{2}} = \boxed{-2}$
5. $\csc(7\pi/6) = \frac{1}{\sin(7\pi/6)} = \frac{1}{-\frac{1}{2}} = \boxed{-2}$

B.E. CAT III

1. $\sin x = \frac{1}{2}$ $\boxed{x = \pi/6,\ 5\pi/6}$
2. $\tan(x) = \frac{-1}{\sqrt{3}} = \frac{-1/2}{\sqrt{3}/2}$ $\boxed{x = \frac{11\pi}{6},\ \frac{5\pi}{6}}$

or $\frac{1/2}{-\sqrt{3}/2}$

3. $\sin x + \cos x = 0$

$\sin x = -\cos x$ $\boxed{x = 3\pi/4,\ 7\pi/4}$

4. $\cos^2 x + \cos x = 0$

$\cos x(\cos x + 1) = 0$ $\to$ $\cos x = 0$ OR $\cos x + 1 = 0$

$\cos x = -1$

$\boxed{x = \pi/2,\ 3\pi/2,\ \pi}$

5. $\sin x - 2\cos x \sin x = 0$

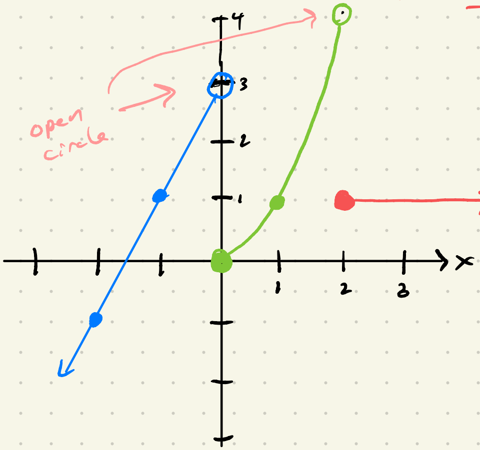
$\sin x(1 - 2\cos x) = 0$ $\to$ $\sin x = 0$ or $1 - 2\cos x = 0$

$\cos x = \frac{1}{2}$

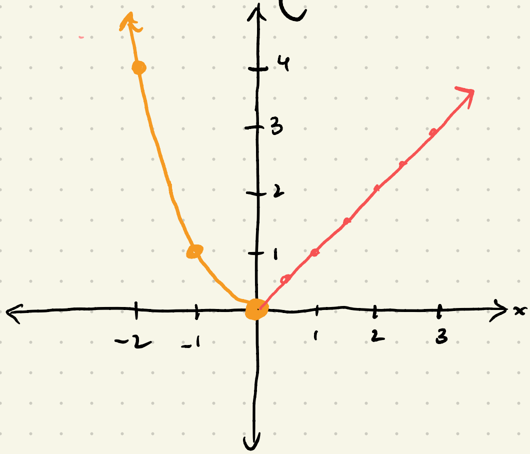
$\boxed{x = 0, \pi, 2\pi, \pi/3, 5\pi/3}$

B.E. CAT IV

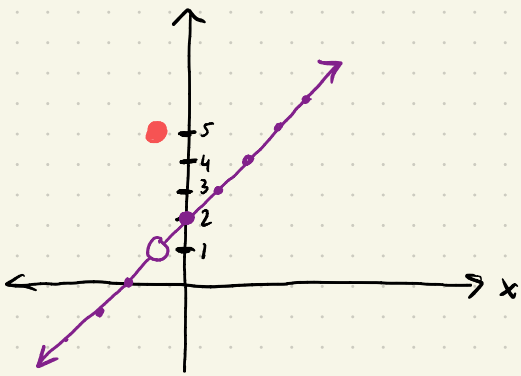
1. $f(x) = \begin{cases} 2x+3 & ; x<0 \\ x^2 & ; 0 \le x < 2 \\ 1 & ; x \ge 2 \end{cases}$



3. $h(x) = \begin{cases} x^2 & ; x \le 0 \\ x & ; x > 0 \end{cases}$



2. $r(x) = \begin{cases} x+2 & ; x \ne -1 \\ 5 & ; x = -1 \end{cases}$



removable discontinuity at $x=-1$