

#1. Discuss and sketch the graph of  $y = \frac{x}{3} + 2 + \frac{3}{x}$

Determine the value of  $x$  for which the graph is

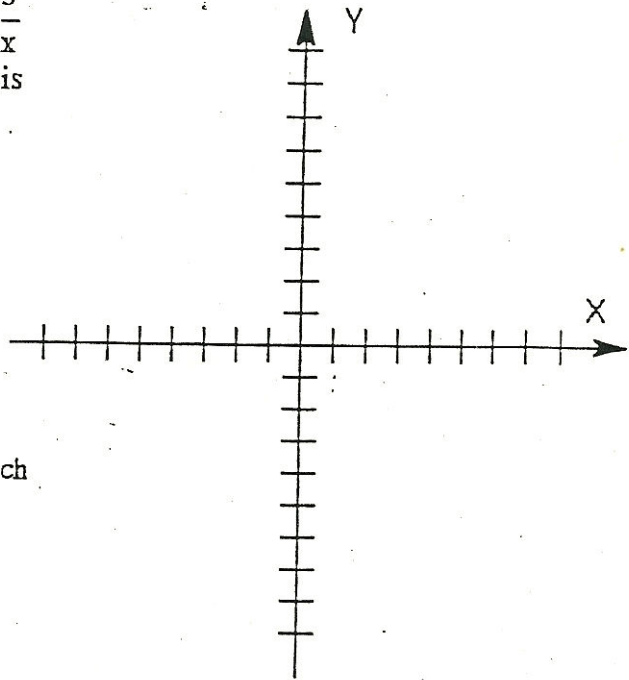
- A. continuous
- B. rising
- C. falling
- D. concave upward
- E. concave downward

Determine the coordinates of the points at which the curve has a

- F. relative maximum
- G. relative minimum

H. Relate this graph with that of  $y = \frac{x}{3} + 2$  as  $x \rightarrow \infty$ .

J. Sketch  $y = \frac{x}{3} + 2 + \frac{3}{x}$



#2. Determine the following about the graph of the equation  $y = \frac{8}{x^3} - \frac{6}{x}$ .

(a) Is the graph symmetric with respect to:

- (1) the X-axis?
- (2) the Y-axis?
- (3) the origin?

(b) Identify all asymptotes of the graph.

(c) Find the  $x$ -coordinate of each point at which  $y$  is a relative maximum and of each point at which  $y$  is a relative minimum. Justify your answer.

(d) Find the  $x$ -coordinate of each point of inflection. Justify your answer.

#3 Let  $f(x) = 4x^3 - 3x - 1$ .

(a) Find the  $x$ -intercepts of the graph of  $f$ .

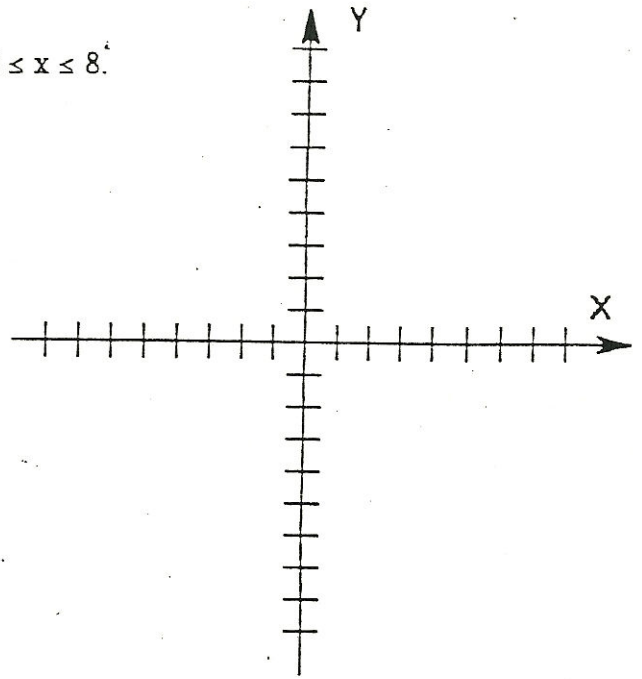
(b) Write an equation for the tangent line to the graph of  $f$  at  $x = 2$ .

(c) Write an equation of the graph that is the reflection across the  $Y$ -axis of the graph of  $f$ .

Category # 2 Tangent \* Normal Ch 3

#4 Consider the function  $f(x) = x^{\frac{4}{3}} + 4x^{\frac{1}{3}}$  on the interval  $-8 \leq x \leq 8$ .

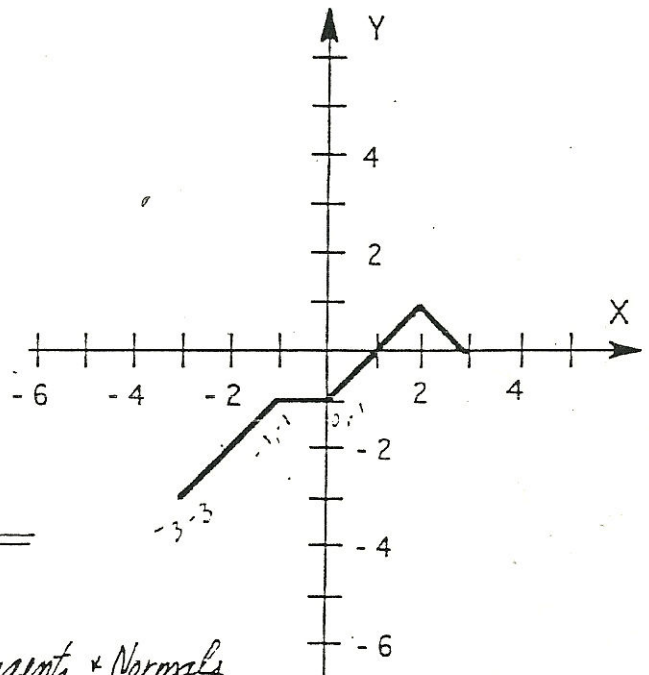
- Find the coordinates of all points at which the tangent to the curve is a horizontal line.
- Find the coordinates of all points at which the tangent to the curve is a vertical line.
- Find the coordinates of all points at which the absolute maximum and absolute minimum occur.
- For what values of  $x$  is this function concave down?
- On the axes provided, graph the function on this interval.



Category # 8 Graphing Ch. 3

#5 A function  $f$  is defined on the closed interval from  $-3$  to  $3$  and has the graph shown below.

- On the axes provided sketch the entire graph of  $y = |f(x)|$ .
- On the axes provided sketch the entire graph of  $y = f(|x|)$ .
- On the axes provided sketch the entire graph of  $y = f(-x)$ .
- On the axes provided sketch the entire graph of  $y = f(x/2)$ .
- On the axes provided sketch the entire graph of  $y = f(x-1)$ .



$$f(x) = \frac{2x}{x-1}$$

Category # 2 Tangents \* Normal

- Find zeros
- Find equations of vertical asymptotes
- Find equations of horizontal asymptotes
- Find equation of each line normal to  $f(x) = \frac{2x}{x-1}$  and parallel to  $2x - y + 1 = 0$
- Sketch  $f$  and normal lines.

Category #3 Differentiation Ch. 3

#7

$$y = (a^3 - x^2)^2$$

A) Find  $\frac{dy}{dx}$

B)  $\frac{d}{dx} \left( \frac{1}{x^2} - \frac{1}{x} + x^3 \right)$  at  $x = -2$

$$y = x^3 + 2 \quad u = 3x - 5$$

C) Find  $\frac{dy}{du}$

#8

Category #1 Definition Ch. 3

Let  $f$  be the function defined as follows

$$f(x) = \begin{cases} |x-1| + 2 & \text{for } x < 1 \\ ax^2 + bx & \text{for } x \geq 1 \end{cases}$$

where  $a$  and  $b$  are constants

- A) If  $a=2$  and  $b=3$ , is  $f$  continuous for all  $x$ ? Justify  
 B) Describe all values of  $a$  and  $b$  for which  $f$  is a continuous function.  
 C) For what values of  $a$  and  $b$  is  $f$  both continuous and differentiable

#9

Category #3 Differentiation Ch 3

Given the curve  $x^2 - xy + y^2 = 9$

- A) Write the general expression for the slope of the curve.  
 B) Find the coordinates of the points on the curve where the tangents are vertical.  
 C) At the point  $(0,3)$ , find the rate of change in the slope of the curve with respect to  $x$ .

#10

Category #2 Tangents + Normal Ch. 3

Given  $f(x) = x^2 + 1$  Pt  $(1,2)$

- A) Find the equation of the normal line to the graph of  $f$  at the indicated point.  
 B) Sketch the curve, the tangent line, and the normal line.

Category #2 Tangent + Normals Ch. 3

#11

Given  $f(x) = (4x^2 - 8x + 3)^4$  Pt(2,81)

- A) Find the equation of the tangent line at the point  
 B) Find the points of the graph at which the tangent line is horizontal.

Category #5 Velocity Ch. 3

#12

A particle starts at time  $t=0$  and moves on a number line so that its position at time  $t$  is given by  $x(t) = (t-2)^3(t-6)$

- A) When is the particle moving to the right?  
 B) When is the particle at rest?  
 C) When does the particle change direction?  
 D) What is the farthest to the left of the origin that the particle moves?

Category #2 Tangent + Normals Ch. 3

#13

Let  $f$  be the function given by  $f(x) = \frac{4x-5}{x^2-9}$

- A) Find domain of  $f$   
 B) Find  $f'(x)$   
 C) Write an equation for the line tangent to the graph of  $f$  at the point  $(0, f(0))$

Category #2 Tangent + Normals Ch. 3

#14

Let  $f$  be the function defined by  $f(x) = 3x^5 - 5x^3 + 2$

- A) On what intervals is  $f$  increasing?  
 B) On what intervals is the graph of  $f$  concave upward?  
 C) Write the equation of each horizontal tangent line to the graph of  $f$ .

#15

Category #1 Definitions Ch. 3

$$f(x) = x^3 - 3x^2 - 4x + 12$$

and

$$h(x) = \begin{cases} \frac{f(x)}{x-3} & \text{for } x \neq 3 \\ p & \text{for } x=3 \end{cases}$$

- A) Find the zeros of the functions  $f$   
 B) Find the value of  $p$  so that the function  $h$  is continuous at  $x=3$ . Justify  
 C) Using the value of  $p$  found in (b), determine whether  $h$  is an even function. Justify.