p. 153 46

Find the equation of the line tangent to the curve at the point defined by the given value of t

$x = 2t^2 + 3 \quad y = t^4 \qquad$ at t = -1 $\qquad (5, 1)$

$\frac{dx}{dt} = 4t \qquad \frac{dy}{dt} = 4t^3$

$y = 1 + 1(x - 5)$

$\frac{dy}{dx} = \frac{4t^3}{4t} = t^2 \Big|_{t=-1} = 1$

p. 182 #51

$\tan = \dfrac{\sin\frac{\pi}{6}}{\cos\frac{\pi}{6}} = \dfrac{\frac{1}{2}}{\frac{\sqrt{3}}{2}} = \dfrac{1}{\sqrt{3}}$

$\cos\frac{\pi}{6} = \cos 30° = \dfrac{\sqrt{3}}{2}$

Find the equation for the line tangent to the curve at the given value of t

$\left(3\left(\frac{2}{\sqrt{3}}\right),\ 5\left(\frac{1}{\sqrt{3}}\right)\right)$

$$x = 3\sec t \quad y = 5\tan t \qquad \text{at } t = \frac{\pi}{6}$$

$\dfrac{dx}{dt} = 3\sec t\tan t \qquad \dfrac{dy}{dt} = 5\sec^2 t$

$\dfrac{dy}{dx} = \dfrac{5\sec^2 t}{3\sec t\tan t} = \left.\dfrac{5\sec t}{3\tan t}\right|_{t=\frac{\pi}{6}} = \dfrac{5\sec\frac{\pi}{6}}{3\tan\frac{\pi}{6}} = \dfrac{5\left(\frac{2}{\sqrt{3}}\right)}{3\left(\frac{1}{\sqrt{3}}\right)} = \dfrac{10}{3}$

$y = \dfrac{5}{\sqrt{3}} + \dfrac{10}{3}\left(x - \dfrac{6}{\sqrt{3}}\right)$

p. 535 #25

Find the points at which the tangent line to the curve is horizontal and/or vertical

$$x = 2 - t \quad y = t^3 - 4t$$

Vertical Tan

$\frac{dx}{dt} = -1$

$0 \neq -1$

No vertical tangents

Horizontal Tangent

$\frac{dy}{dt} = 3t^2 - 4$

$0 = 3t^2 - 4$

$4 = 3t^2$

$\frac{4}{3} = t^2$

$\pm\sqrt{\frac{4}{3}} = t$

$\left(2 - \sqrt{\frac{4}{3}}, \left(\sqrt{\frac{4}{3}}\right)^3 - 4\sqrt{\frac{4}{3}}\right)$

$\left(2 + \sqrt{\frac{4}{3}}, \left(-\sqrt{\frac{4}{3}}\right)^3 + 4\sqrt{\frac{4}{3}}\right)$

1. A curve C is defined by the parametric equations $x = t^2 - 4t + 1$ and $y = t^3$. Find the equation of the line tangent to the graph of C at the point (1, 64)?

$64 = t^3$

$4 = t$

$$\frac{dy}{dx} = \frac{3t^2}{2t-4}\bigg|_{t=4} = \frac{3(16)}{8-4} = \frac{48}{4} = 12$$

$$\boxed{y = 64 + 12(x-1)}$$

- A zoo sponsored a one-day contest to name a new baby elephant. Zoo visitors deposited entries in a special box between noon (t=0) and 8 P.M. (t=8). The number of entries in the box t hours after noon is modeled by a differentiable function E for . Values of E(T), in hundreds of entries, at various times t are shown in the table.

t(hours)	0	2	5	7	8
E(t) (hundreds of entries)	0	4	13	21	23

- Use the data in the table to approximate the rate at time t = 7.5. Show the computations that lead to your answer and explain the meaning of the found rate.

$E'(7.5) = \dfrac{23-21}{8-7} = 2$ hundred entries per hour

At 7:30pm the rate that entries are deposited is 2 hundred per hr.

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t(hours)	0	2	5	7	8
E(t) (hundreds of entries)	0	4	13	21	23

$$\text{Is there a time, t, between } \cancel{4}\,2 \le t \le 8 \text{ at which } E'(t) = \frac{19}{6}?$$

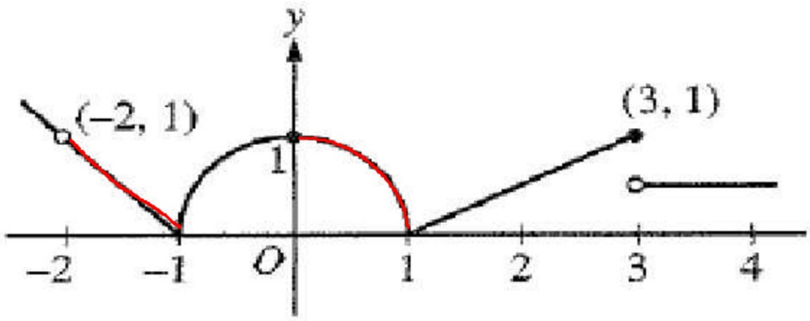
Since E(t) is differentiable the MVT guarantees

that $E'(t) = \frac{19}{6} = \frac{23-4}{8-4}$ between $2 \le t \le 8$

- The function f, whose graph consists of two line segments, is shown. Which of the following are true for f on the open interval (-2, 2)?

~~I.~~ The domain of the derivative of f is the open interval (-2, 2)
II. f is continuous on the open interval (-2,2)
~~III.~~ The derivative of f is positive on the open interval (-2, 2)

a) I only
b) II only
c) III only
d) II and III only
e) I, II, and III



Graph of f

If the function f is continuous at x = 5, which of the following must be true?

$a) f(5) > \lim_{x\to 5} f(x)$

$b) \lim_{x\to 5^-} f(x) \neq \lim_{x\to 5^+} f(x)$

$c) f(5) = \lim_{x\to 5^-} f(x) = \lim_{x\to 5^+} f(x)$

$d)$ The derivative of f at x = 5 exists

e) The derivative of f is negative for x < 5 and positive for x > 5

Function Value = limit from the left = lim from the right