3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

56) $y = \dfrac{|x|}{\sqrt{2-x^2}}$ Find tangent line at $(1,1)$

$$|x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$$

$$y = \frac{x}{\sqrt{2-x^2}}$$

$$y' = \frac{\sqrt{2-x^2}\,(x)' - \left(\sqrt{2-x^2}\right)' x}{\left(\sqrt{2-x^2}\right)^2}$$

$$\left(\sqrt{2-x^2}\right)' = \left((2-x^2)^{1/2}\right)'$$
$$= \tfrac{1}{2}(2-x^2)^{-1/2} \cdot (-2x)$$
$$= -\frac{2x}{2\sqrt{2-x^2}}$$
$$= -\frac{x}{\sqrt{2-x^2}}$$

$$y' = \frac{\sqrt{2-x^2} + \frac{x^2}{\sqrt{2-x^2}}}{2-x^2}$$

$$y'(1) = \frac{\sqrt{2-1} + \frac{1}{\sqrt{2-1}}}{2-1}$$

$$= \frac{1+1}{1} = 2$$

$y'(1) = 2$

$y - 1 = 2(x-1)$

$\boxed{y = 2x - 1}$

b) Graph both on calculator

61) $F(x) = f(g(x))$ $f(-2) = 8$ $f'(-2) = 4$ $f'(5) = 3$

$g(5) = -2$ $g'(5) = 6$

find $F'(5)$: $F'(x) = f'(g(x))\,g'(x)$

$$F'(5) = f'(g(5))\,g'(5)$$
$$= f'(-2) \cdot 6$$
$$= 4 \cdot 6$$

$\boxed{F'(5) = 24}$

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COMET

63) Given the table in the text,

a. If $h(x) = f(g(x))$, find $h'(1)$

$$h'(1) = f'(g(1)) \cdot g'(1)$$
$$= f'(2) \cdot 6$$
$$= 5 \cdot 6$$
$$\boxed{h'(1) = 30}$$

b. If $H(x) = g(f(x))$, find $H'(1)$

$$H'(1) = g'(f(1)) \cdot f'(1)$$
$$= g'(3) \cdot 4$$
$$= 9 \cdot 4$$
$$\boxed{H'(1) = 36}$$

65) Given graphs of f & g in the text.

$u(x) = f(g(x))$ $\quad v(x) = g(f(x))$ $\quad w(x) = g(g(x))$

a. find $u'(1)$ $\quad u'(1) = f'(g(1)) \cdot g'(1)$
$$= f'(3) \cdot -3$$
$$= -\tfrac{1}{4} \cdot (-3)$$
$$\boxed{u'(1) = 3/4}$$

b. find $v'(1)$ $\quad v'(1) = g'(f(1)) \cdot f'(1)$
$$= g'(2) \cdot 2$$

but $g'(2)$ is a corner point & does not exist

$$\boxed{v'(1) \text{ does not exist}}$$

c. find $w'(1)$ $\quad w'(1) = g'(g(1)) \cdot g'(1)$
$$= g'(3) \cdot (-3)$$
$$= 2/3 \cdot (-3)$$
$$\boxed{w'(1) = -2}$$

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COMET

66) Given the graph in the text, let $h(x) = f(f(x))$ and $g(x) = f(x^2)$.

a. estimate $h'(2)$

$h(x) = f(f(x))$

$h'(x) = f'(f(x))\, f'(x)$

$h'(2) = f'(f(2))\, f'(2)$ $\qquad f(2) \approx 1 \quad f'(2) \approx -1$

$= f'(1) \cdot (-1)$ $\qquad f'(-1) \approx 1$

$= (-1)(-1)$

$h'(2) \approx 1$

b) estimate $g'(2)$

$g(x) = f(x^2)$

$g'(x) = f'(x^2)\, 2x$

$= f'(4) \cdot 4$

$= 2 \cdot 4$

$g'(2) \approx 8$

74) For what values of r does $y = e^{rx}$ satisfy $y'' + 5y' - 6y = 0$

$y' = re^{rx} \qquad y'' = r^2 e^{rx}$

$r^2 e^{rx} + 5re^{rx} - 6e^{rx} = 0$

$e^{rx}(r^2 + 5r - 6) = 0$

since e^{rx} is never zero, the equation can only be zero if $r^2 + 5r - 6 = 0$

$(r+6)(r-1) = 0$

$\therefore r = -6, +1$

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COMET

81) $s(t) = 2e^{-1.5t} \sin 2\pi t$

$$v(t) = s'(t) = 2e^{-1.5t}(\sin 2\pi t)' + (2e^{-1.5t})' \sin 2\pi t$$

$$= 2e^{-1.5t}\, 2\pi \cos 2\pi t + (2e^{-1.5t} \cdot -1.5)(\sin 2\pi t)$$

$$= 2e^{-1.5t}(2\pi \cos 2\pi t - 1.5 \sin 2\pi t)$$

Graphs: use calculator with windows $0 \le t \le 2$

$-1 \le y \le 2$ for $s(t)$

$-7 \le y \le 15$ for $v(t)$

89) a. prove deriv of an even fcn is odd using chain rule

definition of even fcn says

$f(-x) = f(x)$

differentiate both sides, and we get

$f'(-x) \cdot (-x)' = f'(x) \cdot (x)'$

$f'(-x) \cdot (-1) = f'(x) \cdot (1)$

$-f'(x) = f'(x)$ ← definition of an odd function

b. prove deriv of an odd function is even

given $f(-x) = -f(x)$, show the derivative is even, i.e., $f'(-x) = f'(x)$

$f(-x) = -f(x)$

differentiate both sides

$f'(-x) \cdot (-x)' = -f'(x)\,(x)'$

$-f'(-x) = -f'(x)$

$\Rightarrow f'(-x) = f'(x)$