

Short Answers to Review Problems for Exam 2

(1)  $f'(x) = \frac{(\ln 5)5^x + \cos x}{5^x + \sin x}$ ,  $g'(x) = \sec(\sqrt{x^2 + 1}) \tan(\sqrt{x^2 + 1}) \left( \frac{x}{\sqrt{x^2 + 1}} \right)$ .

(2)  $-(1/4)(\sin^2 x)(2 + \cos x)^{-3/2} - (1/2)(\cos x)(2 + \cos x)^{-1/2}$ .

(3)  $(x^{\sin x}) \left( \cos x \ln x + \frac{\sin x}{x} \right)$ .

(4)  $\frac{dy}{dx} = -\frac{x}{3y}$ ,  $\frac{d^2y}{dx^2} = -\frac{1}{9y^3}$ .

(5)  $y - 2 = -(102/135)(x - 3)$ .

(6) 6/5 square inches per second.

(7) 4 feet per second.

(8)  $L(x) = 13 + 12(x - 2)$ .

(9)  $9 - \frac{1}{1800}$ .

(10) Critical numbers at  $x = -2$ ,  $x = 2$ ,  $x = 6$ . Relative maximum at  $x = 2$ . Relative minimum (and absolute minimum) at  $x = -2$ ,  $x = 6$ .

(11) If  $f'(c)$  exists, then  $f'(c) = 1$  or  $f'(c) = -1$ . However,  $(f(3) - f(-2))/(3 - (-2)) = 1/5$ . The Mean Value Theorem does not apply because  $f$  is not differentiable at 0, which is a number in the open interval  $(-2, 3)$ .

(12) Increasing on  $(-\infty, -1)$ ,  $(-1/\sqrt{2}, 1/\sqrt{2})$  and  $(1, \infty)$ . Decreasing on  $(-1, -1/\sqrt{2})$  and  $(1/\sqrt{2}, 1)$ . Concave up on  $(-\sqrt{3}/2, 0)$ ,  $(\sqrt{3}/2, \infty)$ . Concave down on  $(-\infty, -\sqrt{3}/2)$ ,  $(0, \sqrt{3}/2)$ . Relative maximum at  $x = -1$ ,  $x = 1/\sqrt{2}$ . Relative minimum at  $x = -1/\sqrt{2}$ ,  $x = 1$ . Inflection points at  $x = -\sqrt{3}/2$ ,  $x = 0$ ,  $x = \sqrt{3}/2$ .

(13) Increasing on  $(1/e, \infty)$ . Decreasing on  $(0, 1/e)$ . Absolute minimum at  $x = 1/e$ . The definition  $f(0) = 0$  makes  $f$  right continuous at 0.

(14) Increasing on  $(-\infty, 1)$ . Decreasing on  $(1, \infty)$ . Concave up on  $(2, \infty)$ . Concave down on  $(-\infty, 2)$ . Inflection point at  $x = 2$ . Relative maximum (and absolute maximum) at  $x = 1$ .

(15) Decreasing on  $(-\infty, -\sqrt{2})$ ,  $(-\sqrt{2}, \sqrt{2})$ ,  $(\sqrt{2}, \infty)$ . Concave up on  $(-\sqrt{2}, 0)$ ,  $(\sqrt{2}, \infty)$ . Concave down on  $(-\infty, -\sqrt{2})$ ,  $(0, \sqrt{2})$ . Inflection point at  $x = 0$ . Horizontal asymptote:  $y = 0$ . Vertical asymptotes:  $x = -\sqrt{2}$ ,  $x = \sqrt{2}$ .

(16)  $-\sqrt{5}$ .

(17) 4/9.

(18)  $e^2$ .

(19) 9/2 square inches.

(20)  $6\pi(25/\pi)^{2/3}$  square inches.