

MAC2311 Section U08  
Suggested problems for Test 3  
(Test 3 is Friday April 7th, in class)

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1. Find  $dy/dx$ .

$$y = e^{7x}$$

2. Find  $dy/dx$ .

$$y = e^{-5x^2}$$

3. Find  $dy/dx$ .

$$y = x^3 e^x$$

4. Find  $dy/dx$ .

$$y = e^{1/x}$$

5. Find  $dy/dx$ .

$$y = \frac{e^x - e^{-x}}{e^x + e^{-x}}$$

6. Find  $dy/dx$  using any correct method.

$$y = x^{\sin x}$$

7. Find  $dy/dx$  using any correct method.

$$y = (x^3 - 2x)^{\ln x}$$

8. Find  $dy/dx$ .

$$y = \sin^{-1} x$$

9. Find  $dy/dx$ .

$$y = \frac{1}{\tan^{-1} x}$$

**10.** There is a circular oil spill whose radius is increasing at a constant rate of 2 ft/sec. How fast is the area of the spill increasing when the radius of the spill is 60 ft?

**11.** A 13 ft ladder is leaning against a wall. If the top of the ladder slips down the wall at 2 ft/sec, how fast will the bottom be moving away from the wall when the top is 5 ft above the ground?

**12.** Find the local linear approximation of the function  $f(x) = \sqrt{1+x}$  at  $x_0 = 0$ , and use it to estimate  $\sqrt{0.9}$  and  $\sqrt{1.1}$ .

**13.** Find the local linear approximation of the function  $f(x) = \frac{1}{1+x}$  at  $x_0 = 0$ , and use it to estimate  $\frac{1}{1.02}$  and  $\frac{1}{1.03}$ .

14. Evaluate the limit.

$$\lim_{x \rightarrow 0} \frac{x^2}{\sin x}$$

15. Evaluate the limit.

$$\lim_{x \rightarrow 0} \frac{e^x - 1}{\sin x}$$

16. Evaluate the limit.

$$\lim_{x \rightarrow 0} \frac{\sin 2x}{\sin 5x}$$



17. Evaluate the limit.

$$\lim_{x \rightarrow 0} (1 - 3x)^{1/x}$$

18. Evaluate the limit.

$$\lim_{x \rightarrow \infty} (\ln x)^{1/x}$$

19. Evaluate the limit.

$$\lim_{x \rightarrow \infty} x^{1/\ln x}$$

**20.** Find the intervals on which the function is increasing, decreasing, concave up, or concave down.

$$f(x) = 5 - 4x - x^2$$

**21.** Find the intervals on which the function is increasing, decreasing, concave up, or concave down.

$$f(x) = (2x + 1)^3$$

**22.** Find the intervals on which the function is increasing, decreasing, concave up, or concave down.

$$f(x) = 5 + 12x - x^3$$

**23.** Find the intervals on which the function is increasing, decreasing, concave up, or concave down.

$$f(x) = \frac{x}{x^2 + 4}$$

**24.** Find the intervals on which the function is increasing, decreasing, concave up, or concave down.

$$f(x) = x^{4/3} - x^{1/3}$$

**25.** Find all the critical points of the function.

$$f(x) = 4x^4 - 16x^2 + 17$$

**26.** Find all the critical points of the function.

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

**27.** Find all the critical points of the function.

$$f(x) = \frac{x+1}{x^2+3}$$

**28.** Find all the critical points of the function.

$$f(x) = (x^2 - 25)^{1/3}$$

**29.** Find all the relative extrema of the function, and classify each of them as a minimum or a maximum.

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

**30.** Find all the relative extrema of the function, and classify each of them as a minimum or a maximum.

$$f(x) = 2x + 3x^{2/3}$$

**31.** Find all the relative extrema of the function, and classify each of them as a minimum or a maximum.

$$f(x) = \frac{x^2}{x^4 + 16}$$



**32.** Find all the relative extrema of the function, and classify each of them as a minimum or a maximum.

$$f(x) = \ln(2 + x^2)$$