

EXTRA CREDIT:

1) Differentiate

$$f(x) = (x^4 + 3x^2 + 8) \cos x$$

$$f(x) = \sqrt{x} + 7 \tan x - 3 \cos x \sin x$$

$$f(x) = 4x + \sqrt{2} \cos x$$

2) For the third problem above, find the equation of the tangent line to the curve at  $x = \pi/4$

3) Find critical points of  $f(x) = 4x^3 + 3x^2$  on the interval  $[-10, 10]$  and decide whether they are max or min.

4) Find points on graph of  $f(x) = \frac{1}{3}x^3 + x^2 - x - 1$  where the slope is  $-1, 2, 0$ .

5) Integrate  $\int_0^1 (x^4 + x^2 + 1) dx$

$$\int_0^1 \frac{x}{1+x^2} dx$$

$$\int_0^3 (x^3 + 3x)^8 (x^2 + 1) dx$$

$$\int_0^2 x \cos(3x^2) dx$$

6) Integrate

$$\int_{-\pi/2}^{\pi/2} (\sin^3 x \cos x + \sin x \cos x) dx$$

$$\int (x^2 + 2x + 1)^2 dx$$

$$\int \tan^2 x \sec^2 x dx$$

$$\int \sin 4x dx$$

7) Find  $f$  if

$$f' = \frac{u^2 + \sqrt{u}}{u} \quad f(1) = 3$$

$$f'' = 2x^3 + 3x^2 - 4x + 5 \quad \begin{array}{l} f(0) = 2 \\ f(1) = 0 \end{array}$$

8) Find the limit

$$\lim_{x \rightarrow \infty} \sqrt{4x^2 + 3x} - 2x$$

$$\lim_{x \rightarrow \infty} \sqrt{x+8} - \sqrt{x-7}$$

9) Sketch:

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

find max  
min  
concavity

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

10) Show that  
exactly

$3x + 2 \cos x + 5 = 0$  has  
ONE real root

11) Find the point on the curve  $xy = 8$  that is closest to  $(3, 0)$

12) Sketch  $y = \sqrt{1-x} + \sqrt{1+x}$   
 $y = x\sqrt{2+x}$

13) A storage tank with volume  $V$  is to be built in the shape of a right circular cylinder surmounted by a hemisphere. What dimensions will require the least amount of metal?

14) Find max and min in the given interval

$$f(x) = \sqrt{x^2 + x + 1} \quad [-2, 1]$$

$$f(x) = x + 2\cos x \quad [-\pi, \pi]$$

$$f(x) = \sin^2 x + \cos^2 x \quad [0, \pi]$$

15) Differentiate  $y = \frac{\tan x}{1 + \cos x}$

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

$$x \tan y = y - 1$$

$$y = \sin(\tan \sqrt{1+x^3})$$

16) Find a parabola that goes through the point  $(1, 4)$ , and whose tangent lines at  $x = -1$  and  $x = 5$  have ~~the~~ slopes 6 and  $-2$ , respectively.

17) Differentiate the double angle formula

$$\cos 2x = \cos^2 x - \sin^2 x$$

Do you recognize the result ~~for~~ for the double angle formula of the sine? Simplify.

18) Find the limit

$$\lim_{x \rightarrow 1} \frac{x^2 - 9}{x^2 + 2x - 3}$$

$$\lim_{x \rightarrow 0} \cos(x + \sin x)$$

$$\lim_{x \rightarrow 2} \frac{x^2 + 2x - 8}{x^4 - 16}$$

19) Find area between curves:

$$y = \sin x, \quad y = x, \quad x = \pi/2, \quad x = \pi$$
$$x = 1 - y^2, \quad x = y^2 - 1$$
$$y = \cos x, \quad y = 1 - \frac{2x}{\pi}$$

20) Prove volume of a sphere of radius  $R$  is  $V = \frac{4}{3}\pi R^3$ .