

## MAT 131 sample problems for test 2

The following problems are not homework.

1. Find the limits.

1)

$$\lim_{x \rightarrow +\infty} \frac{3x^2 + 5x - 2}{4x^2 - 9}$$

2)

$$\lim_{x \rightarrow +\infty} (\sqrt{x^2 + 1} - x)$$

3)

$$\lim_{x \rightarrow 0^-} 2^{\frac{1}{x}}$$

4)

$$\lim_{x \rightarrow 1} \left( \frac{1}{x-1} + \frac{2}{x^2 - 4x + 3} \right)$$

5)

$$\lim_{x \rightarrow \pi^-} \ln(\sin x)$$

6)

$$\lim_{x \rightarrow -\infty} (\sqrt{x^2 - x} - \sqrt{x^2 + 4x + 1})$$

7)

$$\lim_{x \rightarrow -\infty} (e^x \cdot \sin x)$$

8)

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

9)

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

10)

$$\lim_{x \rightarrow +\infty} \frac{x^3}{2^x}$$

11)

$$\lim_{x \rightarrow +\infty} \arctan x$$

12

$$\lim_{x \rightarrow 0} \frac{3^x - 1}{2^x - 1}$$

13

$$\lim_{x \rightarrow \pi/3} \frac{\cos x - \frac{1}{2}}{x - \frac{\pi}{3}}$$

14

$$\lim_{x \rightarrow 0} x \cdot \sin \frac{1}{x^2}$$

2. Find the derivatives.

1)

$$f(x) = \frac{(x^2 + 4x + 3) \cdot x^{\frac{4}{3}}}{(x^3 - 1)^4}$$

2)

$$f(x) = e^{\cos x}$$

3)

$$f(x) = \arctan(\ln(x^2 + 1))$$

4)

$$f(x) = \sin(x + \cos x)$$

5)

$$f(x) = e^{x \cdot (\tan x)^2}$$

6)

$$f(x) = \sqrt[4]{x + \sqrt[3]{x}}$$

3. Find  $y'$  (The results should be in terms of  $x$  and  $y$ .)

1)

$$x^4 y + xy^2 = x + 3y$$

2)

$$x^2 \cos y + \sin(2y) = xy$$

3)

$$xe^y = y - 1$$

4)

$$\sin(xy) = x^2 - y$$

4. Sketch the graph for function:

1)

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

2) If we know that  $f'(x) = \frac{x}{1+x^2}$  and  $f(0) = 0$ .

3)

$$f(x) = e^{\sin x}, x \in (0, \pi)$$

5 Find the tangent lines at given points.

1)  $x = \ln t, y = t^2 + 1, (0, 2)$

2)  $x = t^3 - 2t^2 + t + 1, y = t^2 + t, (1, 0)$

6. Use a linear approximation to estimate the given number.

1)  $(8.006)^{2/3}$

2)  $1/1001$