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Prerequisites for
MATH 2205, Multivariate Calculus
Semester 2, 2017

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To succeed in this class, you should easily be able to solve the following problems. This is NOT an exhaustive list: the class may also require techniques and concepts not on this list.

A   Single-Variable Calculus

1. Find the equation of the line through $(4, 1)$ and $(-2, 3)$.

2. If $f(x) = \frac{1}{1-x}$ and $g(x) = \sqrt{x-1}$, then what is the formula for the composition $g \circ f$ and what is its domain and range?

3. For an arbitrary function f, how is the graph of $1 + f(-x/2)$ related to the graph of f?

4. Evaluate $\displaystyle\lim_{x \to -\infty} \frac{2x - 1}{\sqrt{3x^2 + x + 1}}$.

5. Evaluate $\displaystyle\lim_{x \to \infty} \frac{\sin x}{x}$.

6. Evaluate $\displaystyle\lim_{x \to 0^+} x^{1/3} e^{-x} - x^{-1/3}$.

7. What is $\displaystyle\lim_{x \to \infty} x^{1/3} e^{-x} - x^{-1/3}$? (You don't need to prove it, just find the answer.)

8. Determine whether the function $f(x) = \begin{cases} \dfrac{3x + 4x^2}{x^2 - x^3} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$ is continuous.

9. If $x\sqrt{x+y} = 8 - xy$, find dy/dx in terms of y and x.

10. Find the equation of the tangent line to $y = \ln(1 + e^x)$ when $x = 0$.

11. Find all points on the curve $y = \dfrac{1}{x^2 + x + 1}$ where the tangent is horizontal.

12. Find the order 3 Taylor polynomial for $\sin(2x)$ about $x = \pi/12$. (Give your answer in terms of squareroots, not decimals.)

13. Find the critical points of $f(x) = (x^2 - 3)e^x$ and determine whether each of them is a local maximum, a local minimum or an inflection point.

14. Determine whether the function $f(x) = |x^2 - x - 2|$ has an absolute maximum and minimum on the interval $[-3, 3]$, and if so, find these values.

15. By finding the (x, y) coordinates of the critical points, the x coordinates of the inflection points and the equations of horizontal and vertical asymptotes, sketch the graph of $f(x) = \dfrac{(2 - x)^2}{x^3}$.

B   Linear Algebra

1. Evaluate the matrix product $\begin{pmatrix} 3 & 0 & -2 \\ 1 & 1 & 2 \\ -1 & 1 & -1 \end{pmatrix} \begin{pmatrix} 2 & 1 \\ 3 & 0 \\ 0 & -2 \end{pmatrix}$.

2. Find the determinant and inverse of the matrix $\begin{pmatrix} 1 & 0 & -1 \\ -1 & 1 & 0 \\ 2 & 1 & 3 \end{pmatrix}$.