Name:

“Knowledge is what is left over after you have forgotten everything else.”

To be done individually. Please answer the following questions which relate to material we will be covering in the course and which you might (or might not) have seen in other math classes. This will give you (and the instructor) useful information about what you know as we start the course. It will not be counted towards your grade.

If there is material you have seen before but do not remember, please get out your old books and notes and review how to do it. If there is material you have never seen before, just say so and leave it blank. No calculators.

For each question, also circle the appropriate number 1 to 4 where
1. indicates you have seen the topic and remember how to do it
2. indicates you have seen the topic, did not remember how to do it, but after reviewing think you understand it and can do it correctly.
3. indicates you have seen the topic, did not remember how to do it, and after reviewing are still not sure how to do it.
4. indicates you have not seen this topic before.
1. For the function $f(x) = 2x^3 + 3x + 1$,

(a) determine the equation of the tangent line to the curve $y = f(x)$ that goes through the point $(x_0 = 1, y_0 = f(1) = 6)$.

(b) use the tangent line equation to estimate the value of $f(1.3)$.

2. For a general function $y = f(x)$, give the equation of the tangent line that goes through the point $(x_0, y_0 = f(x_0))$. This line is also called the linear approximation or the linearization.
3. In one picture, make a rough sketch of both of the functions $e^x$ and $e^{-x}$.

4. For $f(x) = 7e^{-3x}$ calculate $\frac{d}{dx} f(x)$.

5. $\frac{d}{dx} 5x^3 \sin(2x) =$

6. $\int \frac{1}{x} \, dx =$
7. $\int e^x \, dx = $ 

Circle: 1 2 3 4

8. $\int x^2 \sin(3x^3) \, dx = $ 

Circle: 1 2 3 4

9. Graph the curve given by the parametric equations

$$ r(t) = (x(t) = \cos(t), \quad y(t) = \sin(t)), \quad t \in [0, \pi]. $$

Circle: 1 2 3 4
10. Given the parametric curve \( r(t) = (x(t) = \cos(t), y(t) = \sin(t)), t \in [0, \pi], \) determine the tangent vector to this curve at the point \( r(t = \pi/2) \).

11. What is the Taylor Series for \( f(x) = \sin x \) (i.e. the infinite Taylor approximation) based at \( x_0 = 0 \)?

12. For the vector field given by the vector valued function \( \vec{V}(x, y) = (x + y, x - y) \), calculate the vector \( \vec{V}(2, 1) \) and then plot it.
13. Let $A = \begin{bmatrix} 4 & 2 \\ 3 & 1 \end{bmatrix}$ and $b = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$.

(a) Calculate the matrix multiplication $Ab = \quad$ 

(b) Calculate the determinant of $A = \quad$

Circle: 1 2 3 4

14. For the matrix $M = \begin{bmatrix} 3 & 0 \\ 5 & 2 \end{bmatrix}$.

(a) Calculate the eigenvalues of $M$. 

(b) Find one eigenvector of the matrix \( M = \begin{bmatrix} 3 & 0 \\ 5 & 2 \end{bmatrix} \).

Circle: 1 2 3 4

15. Pretend you are a computer and read through the following mini program. Write down everything the computer will print out as it runs through the program

Let sum = 0
For i = 1 to 3
Let sum = sum + i
Print i, sum
Next i
End