Please study Exam 1, 2, 3 and Mastery Exam Reviews. Below is the material from 5.3 and 5.4 that is not covered on those reviews.

5.3

1. Find the exact value of the definite integral \( \int_1^6 2^x \, dx \).
   \[
   \frac{2^6 - 2}{\ln 2}
   \]

2. Find the exact value of the definite integral \( \int_3^{\sqrt{15}} \frac{10}{1 + x^2} \, dx \).
   \[
   10 \tan^{-1}(\sqrt{15}) - 10 \tan^{-1}(3)
   \]

3. Find the exact value of the definite integral \( \int_0^{\pi/4} \frac{3 + \cos^3 x}{\cos^2 x} \, dx \).
   \[
   3 + 0.5\sqrt{2}
   \]

4. Evaluate the definite integral exactly. \( \int_0^{\sqrt{3}/2} \frac{2}{\sqrt{1 - x^2}} \, dx \).
   \[
   \frac{2\pi}{3}
   \]

5. Evaluate the definite integral exactly: \( \int_1^5 \frac{2}{x} \, dx \).
   \[
   10
   \]

6. Evaluate the definite integral exactly: \( \int_1^e (4e^x + 4 \sin x) \, dx \).
   \[
   4e^4 - 4\cos(e) - 4e + 4\cos(1)
   \]
5.4

1. Differentiate \( f(x) = \int_1^{2x} (\cos t - e^{4t} + 1) dt \)

\[ f'(x) = 2(\cos(2x) - e^{8x} + 1) \]

2. Find the derivative of \( \int_{x^3}^{2} \tan^{11}(t) \, dt \)

\[ -3x^2 \tan^{11}(x^3) \]

3. Find the derivative of \( \int_3^x \frac{1}{1 + t^3} \, dt \)

\[ \frac{1}{1 + t^3} \]

4. The linear density in a rod 8 meters long is \( \frac{10}{\sqrt{x} + 1} \) kg/m, where \( x \) is measured in meters from one end of the rod. Find the average density (in kg/m) of the rod

5

5. The temperature in degrees Fahrenheit \( t \) hours after 9 am is modeled by

\[ F(t) = 50 + 19\sin\left(\frac{\pi t}{12}\right) \]

What is the average temperature, to 3 decimal places, from 9 am to 9 pm?

62.096

6. A car drives down a road in such a way that its velocity (in m/s) at time \( t \) (seconds) is

\[ v(t) = 2t^{1/2} + 3 \]

Find the car’s average velocity to three decimal places (in m/s) between \( t = 2 \) and \( t = 4 \).

6.448