Practice Test 4
BUSA130

This exam is graded out of 15 points. You must do Problems 1 and 2. You may choose 5 of the remaining 6 problems.

1) This word problem yields the equation

$$3 = \left(1 + \frac{0.072}{52}\right)^{52(t)},$$

which must be solved for t. This gives

$$\ln(3) = 52t \ln\left(1 + \frac{0.072}{52}\right) \implies t = \frac{\ln(3)}{52 \ln\left(1 + \frac{0.072}{52}\right)} \approx 15.27.$$

2) This word problem yields the equation

$$178000 = 120000\left(1 + \frac{r}{12}\right)^{12(7.5)},$$

which must be solved for r. This gives

$$\ln(1.4833) = 90 \ln\left(1 + \frac{r}{12}\right) \implies \ln\left(1 + \frac{r}{12}\right) = \frac{\ln(1.4833)}{90},$$

then raising e to both sides of the equation, we get

$$1 + \frac{r}{12} = e^{\frac{\ln(1.4833)}{90}} \implies r = 12\left(e^{\frac{\ln(1.4833)}{90}} - 1\right) \approx 0.0527.$$

3) The derivative is $-2xe^{-x^2} + \dfrac{4x}{x^2+1}$.

4) We need the first derivative, which is $f'(x) = (x-1)e^{0.5x^2-x}$, which yields only $x = 1$ as the critical number. Testing the number line split over this critical number, we get that $f'(x)$ is negative (and thus decreasing) on $(-\infty, 1)$ and $f'(x)$ is positive (and thus increasing) on $(1, \infty)$.

5) This problem yields an initial value differential equation: $C'(x) = 0.0015x^2 - 0.06x + 10$, $C(0) = 500$. Integrating, we get the general solution $C(x) = 0.0005x^3 - 0.03x^2 + 10x + C$, and using the initial condition, we see that $C = 500$, so our particular solution is $C(x) = 0.0005x^3 - 0.03x^2 + 10x + 500$, so $C(150) = 3012.5$.

6) We get that $\ln f = \ln(x^3 e^{-x^3}) = 3\ln x - x^3$. Differentiating, we get $\frac{f'}{f} = \frac{3}{x} - 3x^2$, and so $f'(x) = \left(\frac{3}{x} - 3x^2\right)(x^3 e^{-x^3})$.

7) To calculate the indefinite integral $\displaystyle\int e^{-2x+1}\,dx$, let $u = -2x+1$ so that $du = -2dx \implies \frac{du}{-2} = dx$, so substituting, we get

$$\int e^{-2x+1}\,dx = \int e^u \frac{du}{-2} = \frac{1}{-2}\int e^u\,du = -\frac{1}{2}e^u + C = -\frac{1}{2}e^{-2x+1} + C.$$

8) We have $\Delta x = 0.2$, so we approximate the area by

$$0.2\,[f(1.2) + f(1.4) + f(1.6) + f(1.8) + f(2)] \approx 0.389.$$

Bonus: There will be a bonus question worth 0.5pts.