

Review Problems

I. Do the following graphs without the aid of a calculator or computer.

1. $y = 3e^{-2x}$

2. $y = e^{-x} \cos x$

3. $y = \frac{1}{1+e^x}$

4. $y = \frac{1}{2} \sin(3x + \pi)$

5. $y = e^{2 \ln |x|}$

6. $y = x \sin x$

II. Do the following integrals. Take the derivative to check your answer.

1. $\int \frac{1}{x+1} dx$

2. $\int \frac{1}{\sqrt{x+1}} dx$

3. $\int_e^{e^2} \frac{1}{x \ln x} dx$

4. $\int \frac{e^x + e^{-x}}{e^x - e^{-x}} dx$

5. $\int x^2 e^x dx$

6. $\int_0^4 \frac{5}{3x+1} dx$

III. Find all functions $y(x)$ such that ...

1. $y' = \frac{5x}{y}$

2. $y' = \frac{\sqrt{x}}{2y}$

3. $y' = 3y$

4. $y' = x(1+y)$

5. $y' = -\frac{3}{4}\sqrt{x}$ and $y(0) = 10$

6. $y' = 3y$ and $y(0) = 10$

7. $y'' = g$ and $y(0) = 4$, $y(10) = 12$ (g is a constant.)

8. $y'' = \sin x$ and $y(0) = 1$, $y'(0) = 7$

IV. Solve the first order differential equations below.

1. $y' + xy = x$.

2. $xy' = x^2 + 3y$.

3. $e^x y' + 2e^x y = 1$.

4. $xy' + 2y = \sin x$, assume $x > 0$.

5. $y' = xy + 2y + 3x + 6$.

V. Solve the second order differential equations.

1. $y'' - y' - 2y = 0$, $y(0) = 1$, $y'(0) = 2$.

2. $y'' + 3y' + 4y = \sin x$.

3. $y'' + 4y = \cos x$.

4. $y'' + 4y = \cos 2x$.

5. $y'' + y = \csc t$, $0 < t < \pi$.