[7] 1.) Numerical approximations for solutions to differential equations are often needed as the solutions to many differential equations cannot be expressed algebraically.

A) True **B)** False

[7] 2.) For extremely large positive x, $x^{255} < (1.01)^x$

A) True **B)** False

[7] 3.) If f is continuous, then f is integrable.

A) True **B)** False

[7] 4.) Use 3 inscribed rectangles of equal width to estimate $\int_0^\pi sin(x)dx$.

A) 0 **B)** $\frac{1}{2}$ **C)** $\frac{\sqrt{2}}{6}$ **D)** $\frac{\sqrt{3}}{6}$ **E)** 1

F) $\frac{\pi}{6}$ **G)** $\frac{\sqrt{2}\pi}{6}$ **H)** $\frac{\sqrt{3}\pi}{6}$ **I)** $\frac{\pi}{2}$ **J)** π

[7] 5.) If $f(x) = ln\left(\frac{2e^x - e^{-x}}{e^x}\right)$, then the instantaneous rate of change at at $x = 0$ is

A) 0 **B)** 1 **C)** 2 **D)** 3 **E)** 4

F) Does not exist **G)** -1 **H)** -2 **I)** -3 **J)** -4

[7] 6.) Find the equation of the tangent line to $f(x) = \frac{x^2+1}{x+1}$, at $x = 0$

A) $y = x + 1$ **B)** $y = -x + 1$ **C)** $y = x - 1$ **D)** $y = -x - 1$ **E)** $y = 1$

F) $y = x$ **G)** $y = -x$ **H)** $y = 2x + 1$ **I)** $y = 2x - 1$ **J)** $y = -1$

[7] 7.) Use linearization to approximate $\sqrt[3]{9}$

A) 1 **B)** 2 **C)** 3 **D)** $\frac{5}{2}$ **E)** $\frac{9}{4}$

F) $\frac{8}{3}$ **G)** $\frac{10}{3}$ **H)** $\frac{13}{6}$ **I)** $\frac{23}{12}$ **J)** $\frac{25}{12}$

[7] 8.) Suppose the function $f(x) = (sinx)e^{-x}$ represents the concentration of a certain drug in the blood stream during the time period between $x = 0$ and $x = \frac{\pi}{2}$. Find the maximum concentration of drug during this time interval (i.e., in the interval $[0, \frac{\pi}{2}]$).

A) 0 **B)** $\frac{1}{2}e^{-\frac{\pi}{6}}$ **C)** $\frac{\sqrt{2}}{2}e^{-\frac{\pi}{4}}$ **D)** $\frac{\sqrt{3}}{2}e^{-\frac{\pi}{3}}$ **E)** $e^{-\frac{\pi}{2}}$

F) $\frac{\sqrt{3}}{2}e^{-\frac{\pi}{6}}$ **G)** $\frac{1}{2}e^{-\frac{\pi}{4}}$ **H)** $\frac{1}{2}e^{-\frac{\pi}{3}}$ **I)** 1 **J)** Does not exist

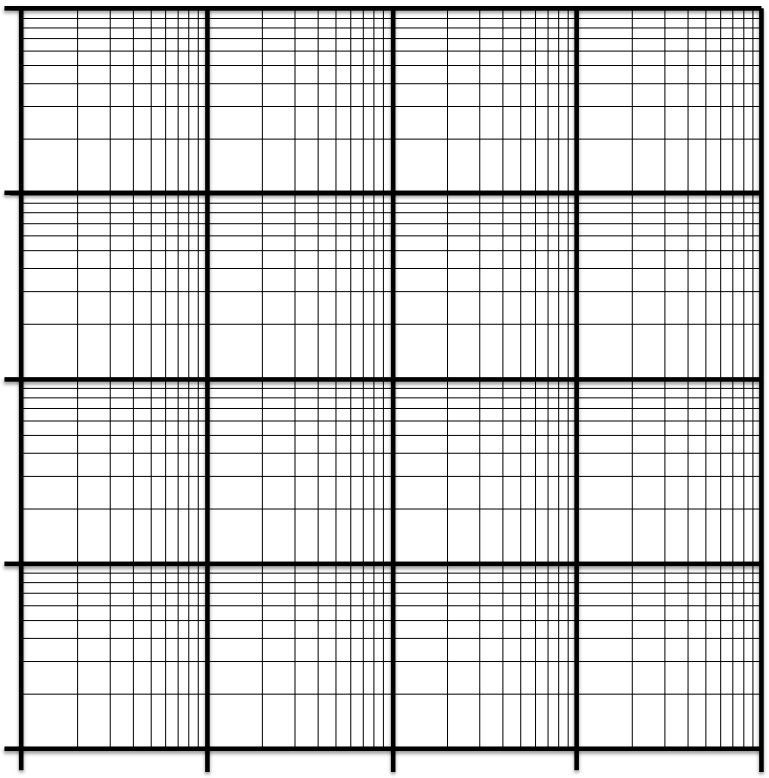
[7] 9.) For the data sets below, graph these points on either semi-log or log-log paper and determine the function from the choices below which best models these data points.

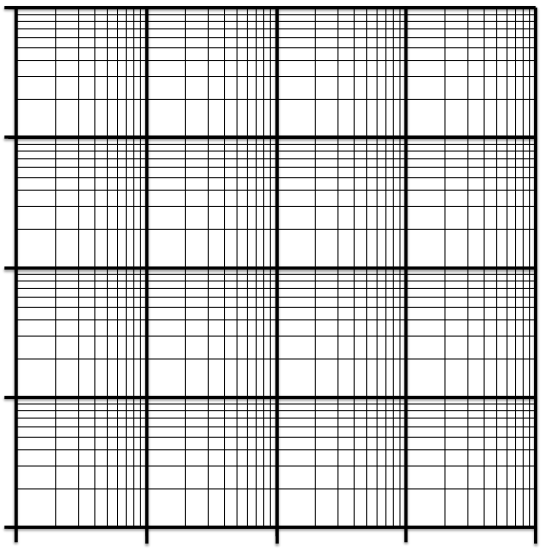
Data set: (1, 1000), (5, 450), (70, 110), (3000, 11)

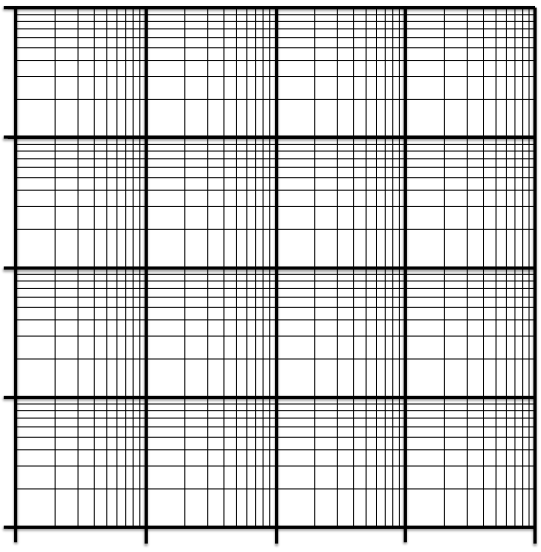
A) $y = 1000t^{-\frac{1}{2}}$ **B)** $y = 1000t^{-\frac{2}{3}}$ **C)** $y = 1000t$ **D)** $y = 1000t^{-\frac{3}{2}}$ **E)** $y = 1000t^{-2}$

F) $y = 1000(10^{-\frac{t}{2}})$ **G)** $y = 1000(10^{-\frac{2t}{3}})$ **H)** $y = 1000(10^{-t})$ **I)** $y = 1000(10^{-\frac{3t}{2}})$

J) $y = 1000(10^{-2t})$







[7] 10.) $\int_0^\infty e^{-x}dx$

A) 1 **B)** $\frac{1}{2}$ **C)** 0 **D)** $-\frac{1}{2}$ **E)** -1

F) $\frac{e}{2}$ **G)** $\frac{e-1}{2}$ **H)** $\frac{1-e}{2}$ **I)** $-\frac{e}{2}$ **J)** Does not exist (Divergent)

[7] 11.) Find the area of the region bounded by $y = 2x$ and $y = \sqrt{x}$

A) $\frac{1}{48}$ **B)** $\frac{3}{32}$ **C)** $\frac{1}{4}$ **D)** $\frac{1}{3}$ **E)** $\frac{1}{2}$

F) $\frac{11}{16}$ **G)** 1 **H)** 2 **I)** $\frac{32}{3}$ **J)** 0

[7] 12.) Polonium-208 is a radioactive element that undergoes exponential decay according to the differential equation: $y' = -ky$. A sample of 10 g of Polonium is placed on a table. Suppose that after 7 years, only 2 g are left. How much Polonium is left after 14 years.

A) $\frac{1}{10}$ g **B)** $\frac{1}{7}$ g **C)** $\frac{1}{5}$ g **D)** $\frac{2}{7}$ g **E)** $\frac{2}{5}$ g

F) $ln(2)$ g **G)** $\frac{1}{2}$ g **H)** 1 g **I)** $\frac{3}{2}$ g **J)** $\frac{5}{2}$ g

[7] 13.) Solve the following initial value problem: $y' = \dfrac{3xy}{x^2+4}$, $y(0) = 1$

A) $y = 0$ **B)** $y = 1$ **C)** $y = \frac{3}{2}x - \frac{1}{2}$ **D)** $y = \frac{1}{4}(x^2+4)$

E) $y = -\frac{3}{2}x(x^2+4)^{-2} + 1$ **F)** $y = -\frac{3}{2}(x^2+4)^{-2} + 4$ **G)** $y = -\frac{3}{2}(x^2+4)^{-2} + \frac{35}{32}$

H) $y = \frac{3}{2}(x^2+4) - 5$ **I)** $y = (x^2+4)^{\frac{3}{2}} - 7$ **J)** $y = \frac{1}{8}(x^2+4)^{\frac{3}{2}}$

[7] 14.) Which of the following could be the general solution to the differential equation whose direction field is given below:

A) $y = t + C$

B) $y = t^2 + C$

C) $y = Ct$

D) $y = Ct^2$

E) $y = Ce^t$

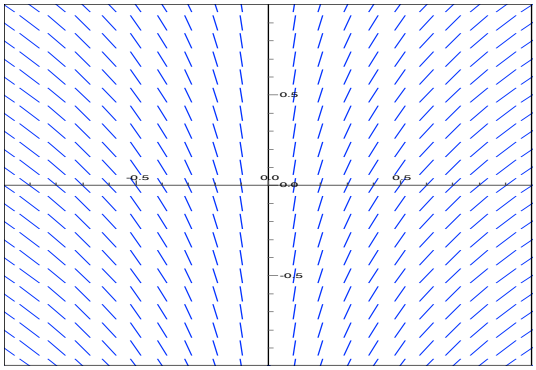
F) $y = Ce^{-t}$

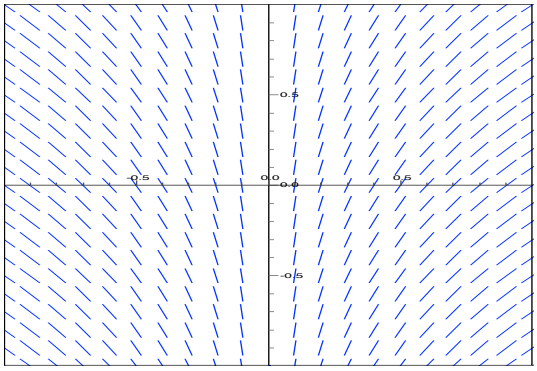
G) $y = ln|t| + C$

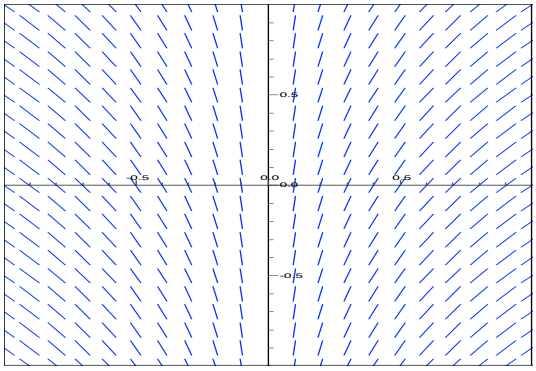
H) $y = C$

I) $y = cos(t) + C$

J) $y = sin(t) + C$







[7] 15.) Determine the equilibrium solutions (values) to the differential equation $y' = y^2(y-2)$. Determine if these solutions are stable, unstable, or semi-stable.

A) $y = 0$ is stable; $y = 2$ is stable

B) $y = 0$ is stable; $y = 2$ is semi-stable

C) $y = 0$ is stable; $y = 2$ is unstable

D) $y = 0$ is semi-stable; $y = 2$ is stable

E) $y = 0$ is semi-stable; $y = 2$ is semi-stable

F) $y = 0$ is semi-stable; $y = 2$ is unstable

G) $y = 0$ is unstable; $y = 2$ is stable

H) $y = 0$ is unstable; $y = 2$ is semi-stable

I) $y = 0$ is unstable; $y = 2$ is unstable

J) There are no equilibrium solutions