#1

[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 $f(x) = ln\left(\dfrac{2e^x - e^{-x}}{e^x}\right)$, 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 $t = 0$ and $t = \frac{\pi}{2}$. 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) $1000t^{-\frac{1}{2}}$ B) $1000t^{-\frac{2}{3}}$ C) $1000t$ D) $1000t^{-\frac{3}{2}}$ E) $1000t^{-2}$
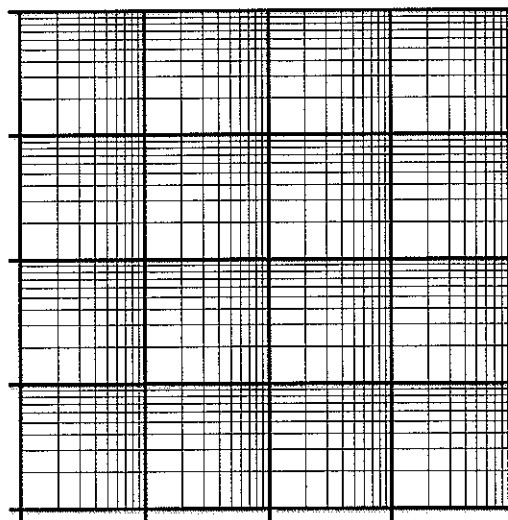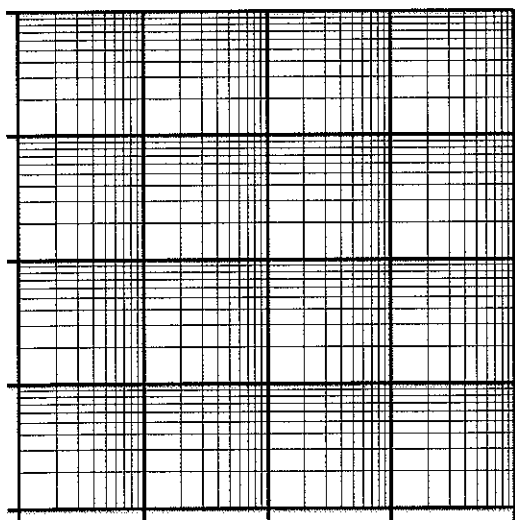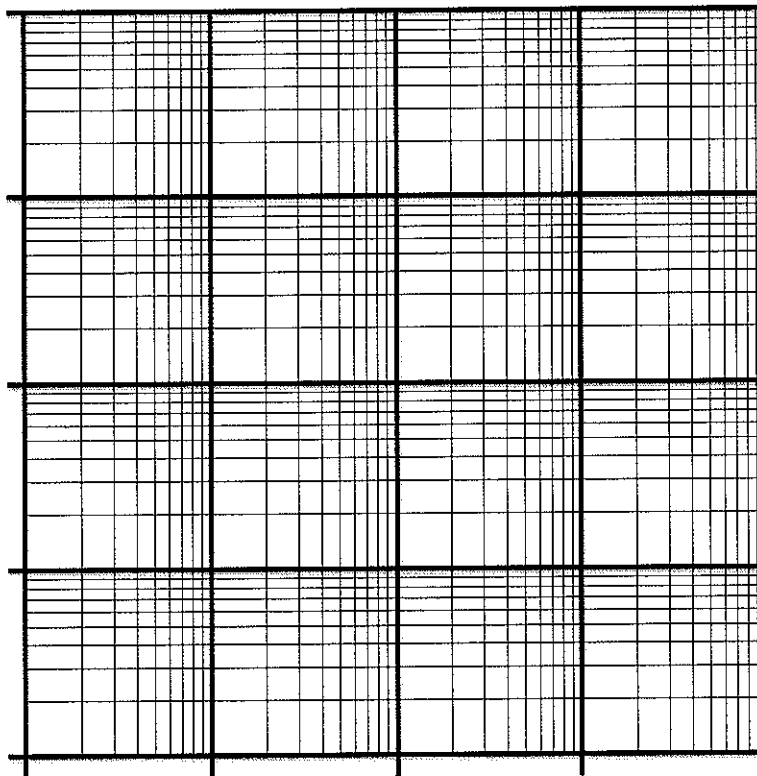
F) $1000(10^{-\frac{t}{2}})$ G) $1000(10^{-\frac{2t}{3}})$ H) $1000(10^{-t})$ I) $1000(10^{-\frac{3t}{2}})$ J) $1000(10^{-2t})$

[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) $y = Ct$
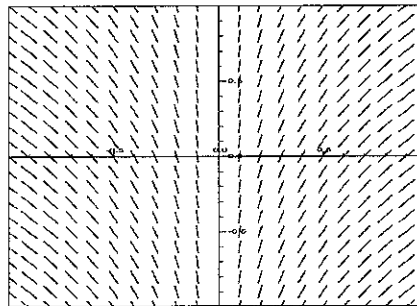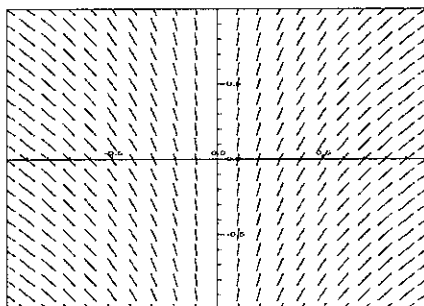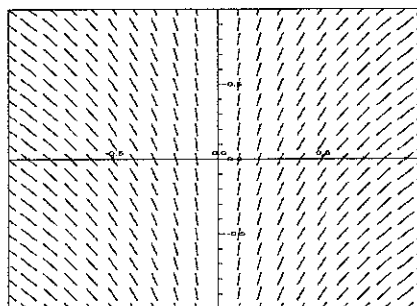
D) $y = Ct^2$

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