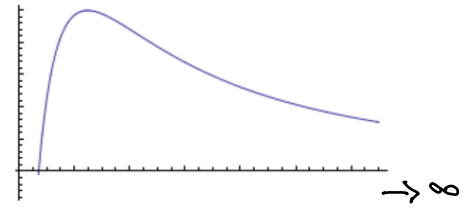


1. Find the area that is enclosed between the  $x$ -axis and the curve  $y = \frac{\ln(x) - 2}{x^2}$  for  $x \geq e^2$ .

- a) -1                      e)  $\frac{1}{e}$   
 b) 0                        f)  $\frac{2}{e^2}$   
 c) 1                        g)  $\frac{1}{e^2}$   
 d)  $e$                       h) The integral diverges



2. Decide whether the integral below converges or diverges. Show all work.

$$\int_5^{\infty} \frac{\sqrt{x^3 - x^2 - 1}}{x^5 + x + 2} dx$$

- a) The integral converges  
 b) The integral diverges

3. The function below is a probability density function. Find the mean.

$$f(x) = \begin{cases} \frac{1}{7} \left( 1 + \frac{2}{\sqrt{x}} \right) & 1 \leq x \leq 4 \\ 0 & \text{otherwise} \end{cases}$$

- a) 1                      e)  $\frac{97}{42}$   
 b)  $\frac{121}{42}$                 f)  $\frac{101}{42}$   
 c)  $\frac{131}{22}$                 g)  $\frac{141}{22}$   
 d)  $\frac{159}{22}$                 h)  $\frac{147}{22}$

4. The function below is a probability density function.

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$$f(x) = \begin{cases} \frac{1}{4}xe^{-x/2} & x \geq 0 \\ 0 & x < 0 \end{cases}$$

Find the probability that  $x \geq 8$ .

a)  $\frac{1}{e^4}$

e)  $\frac{5}{e^4}$

b)  $\frac{2}{e^4}$

f)  $\frac{6}{e^4}$

c)  $\frac{3}{e^4}$

g)  $\frac{7}{e^4}$

d)  $\frac{4}{e^4}$

h)  $\frac{8}{e^4}$

5. Let  $y(x)$  be the solution of the equation

$$x^3 \frac{dy}{dx} + 2y = e^{1/x^2} \quad \text{with } y(1) = e$$

Find  $y\left(\frac{1}{2}\right)$ .

a)  $\frac{4}{e^4}$

e)  $\frac{1}{2e^4}$

b)  $\frac{-1}{2}e^4$

f)  $\frac{1}{4e^4}$

c)  $\frac{-2}{3}e^4$

g)  $\frac{-3}{2}e^4$

d)  $\frac{1}{e^4}$

h)  $\frac{-3}{4}e^4$

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6. Let  $y(x)$  be the solution of the equation below.

$$\frac{x}{y+2} \cdot \frac{dy}{dx} = \frac{1}{x+1} \quad \text{with } y\left(\frac{1}{2}\right) = 1$$

Find  $y(1)$ .

a)  $\frac{1}{2}$                       e)  $\frac{9}{2}$

b)  $\frac{3}{2}$                       f) 2

c)  $\frac{5}{2}$                       g) 1

d)  $\frac{7}{2}$                       h)  $\frac{3}{4}$

7. SET UP (but **DO NOT SOLVE**) the differential equation for the following word problem. Give the differential equation and the initial condition.

A tank initially holds 300 gallons of brine with 8 lbs. of dissolved salt.

Brine that contains 3 lbs. of salt per gallon enters the tank at the rate of 6 gallons per minute and the well stirred mixture leaves at the rate of 8 gallons per minute. Let  $y(t)$  be amount of salt in the tank at time  $t$ . Find the differential equation and initial condition.

**Answers:**

1. G

2. A

3. F

4. E

5. B

6. C

7.

$$\frac{dy}{dt} + \left(\frac{8}{300-2t}\right)y = 18 \quad y(0) = 8.$$