

# 1 | Review Sheet

## 1.1 | Problem 1

### 1.1.1 |(e)

$$f(x) = x(x^2 + 2) - \sin(x^4 - x^{90}) + e^{\sin(x)} + \ln \cos(x^2)$$

$$\backslash \left[ f'(x) = 3x^2 + 2 - (4x^3 - 90x^{89}) \cos(x^4 - x^{90}) + \cos(x) e^{\sin(x)} + -\frac{2x \sin(x^2)}{\cos(x^2)} \right] \backslash$$

### 1.1.2 |(f)

$$y = \frac{x^5 + x^{25}}{\sin(x)} + x^5 \sin(x) + x^3 \sin(x) e^{5x}$$

$$\backslash \left[ \frac{d}{dx}[y] = \frac{\sin(x)(5x^4 + 25x^{24}) - \cos(x)(x^4 + x^{25})}{\sin^2(x)} + (5x^4 \sin(x) + x^5 \cos(x)) + ((3x^2 \sin(x) + x^3 \cos(x)) e^{5x} + 5x^4 \sin(x) \right] \backslash$$

## 1.2 | Problem 4

### 1.2.1 |(a)

$$V = 24.0 \text{ L mol}^{-1}$$

$$V(t) = 24t$$

$$R(t) = \sqrt[3]{\frac{3}{4}V(t)}$$

$$= \sqrt[3]{18t}$$

$$t = 3$$

$$V(3) = 72 \text{ L}$$

$$\backslash \left[ R(3) = 3\sqrt[3]{2} * 10 \text{ cm} \quad = 30\sqrt[3]{2} \text{ cm} \right] \backslash$$

$$V'(t) = 24$$

$$R'(t) = \frac{18}{\sqrt[3]{18t^2}}$$

$$V'(3) = 24 \text{ L s}^{-1}$$

$$R'(3) = \frac{18}{\sqrt[3]{18(3)^2}}$$

$$= \frac{18}{6\sqrt[3]{2}} * 10 \text{ cm s}^{-1} = \frac{30}{\sqrt[3]{2}} \text{ cm s}^{-1}$$

## 1.2.2 |(b)

Assuming that the question is asking how much time would have passed when the radius is 3m: \[

$$3m = 30 * 10cm$$

$$R(t) = 30$$

$$\sqrt[3]{18t} = 30$$

$$18t = 30^3 \quad \backslash]$$

$$t = \frac{30^3}{18}$$

$$= 1500$$

## 1.3 | Problem 5

## 1.3.1 |(e)

$$\int (4y - y^2 + 4y^3 + 1)^{-2/3} (12y^2 - 2y + 4) dy$$

$$\backslash[ \quad \quad \quad = 3 \int \frac{1}{3} (4y - y^2 + 4y^3 + 1)^{-2/3} (12y^2 - 2y + 4) dy \quad \backslash]$$

$$= 3(4y - 4^2 + 4y^3 + 1)^{1/3} + C$$

## 1.3.2 |(f)

$$\int 2x \cos(x) dx = 2x \sin(x) - \int 2 \sin(x) dx$$

$$\backslash[ \quad \quad \quad = 2x \sin(x) - 2 \int \sin(x) dx \quad \backslash]$$

$$= 2x \sin(x) + 2 \cos(x)$$

## 2 | Arc Length

## 2.1 | Problem 2

$$f(x) = \frac{x^2}{8} - \ln x$$

$$f'(x) = \frac{1}{4}x - \frac{1}{x}$$

$$\begin{aligned} L &= \int_1^2 \sqrt{1 + f'(x)^2} dx \\ \backslash [ &= \int_1^2 \sqrt{1 + \left(\frac{1}{16}x^2 - \frac{1}{2} + \frac{1}{x^2}\right)} dx \backslash ] \\ &= \int_1^2 \sqrt{\frac{1}{16}x^2 + \frac{1}{2} + \frac{1}{x^2}} dx \\ &= \left[ \frac{\sqrt{\frac{(x^2+4)^2}{x^2}} (x^3 + 8x \log(x))}{8(x^2 + 4)} \right]_1^2 \\ &= \frac{3}{8} + \log 2 \end{aligned}$$

## 2.2 | Problem 8

$$f(x) = x^2$$

$$f'(x) = 2x$$

$$\backslash [ f'(x) = 6 \quad \backslash ]$$

$$2x = 6$$

$$x = 3$$