

$$1) L = \int_a^b \sqrt{1 + [f'(x)]^2} dx$$

$$f(x) = x^3 \quad f'(x) = 3x^2$$

$$L = \int_0^2 \sqrt{1 + 9x^4} dx \quad (E)$$

$$2) L = \int_1^4 \sqrt{1 + 9x^4} dx$$

$$[f'(x)]^2 = 9x^4$$

$$f'(x) = 3x^2$$

$$f(x) = x^3 + C$$

$$f(1) = 1 + C = 6$$

$$C = 5$$

$$f(x) = x^3 + 5 \quad (B)$$

$$3) y = \cos(2x)$$

$$y' = -2\sin(2x)$$

$$L = \int_0^{\pi/4} \sqrt{1 + (-2\sin(2x))^2} dx$$

$$= 1.318 \quad (D)$$

$$4) x = y^3 \quad \frac{dx}{dy} = 3y^2$$

$$L = \int_{-2}^2 \sqrt{1 + 9y^4} dy \quad (C)$$

$$5) y = \frac{2}{3}x^{3/2}$$

$$\frac{dy}{dx} = x^{1/2}$$

$$L = \int_0^8 \sqrt{1 + x} dx$$

$$= \frac{2}{3}(1+x)^{3/2} \Big|_0^8$$

$$= \frac{2}{3}(9)^{3/2} - \frac{2}{3}$$

$$= \frac{2}{3}(27) - \frac{2}{3}$$

$$= \boxed{\frac{52}{3}} \quad (B)$$

$$6) y = x^{2/3}$$

$$\frac{dy}{dx} = \frac{2}{3}x^{-1/3}$$

$$L = \int_{-1}^1 \sqrt{1 + \left(\frac{2}{3}x^{-1/3}\right)^2} dx$$

$$= \int_{-1}^1 \sqrt{1 + \frac{4}{9}x^{-2/3}} dx$$

$$\overset{0.2}{x} = y^{3/2} \quad \frac{dx}{dy} = \frac{3}{2}y^{1/2}$$

$$L = 2 \int_0^1 \sqrt{1 + \frac{9}{4}y} dy \quad (A)$$

$$7) y_1 = 4x - x^3 + 1 \quad y_2 = \frac{3}{4}x$$

$$y_1 = y_2 @ x = 1.9404 \rightarrow B$$

$$a) \text{ Area} = \int_0^B [y_1 - y_2] dx$$

$$= 4.514$$

$$b) \text{ WASHER}$$

$$V = \pi \int_0^B [(y_1)^2 - (y_2)^2] dx$$

$$= 57.463$$

$$c) y_1(0) = 1$$

$$L = 1 + \int_0^A \sqrt{1 + (4 - 3x^2)^2} dx + \int_0^A \sqrt{1 + \left(\frac{3}{4}\right)^2} dx$$

$$8) a) f_{\text{avg}} = \frac{1}{5} \int_0^5 f(x) dx$$

$$= \frac{1}{5} [-10] = \boxed{-2}$$

$$b) \int_0^{10} (3f(x) + 2) dx$$

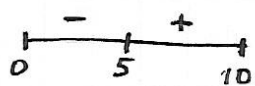
$$3 \int_0^{10} f(x) dx + \int_0^{10} 2 dx$$

$$3[-10 + 27] + 20 = \boxed{71}$$

$$c) g(x) = \int_5^x f(t) dt$$

$$g'(x) = f(x) = 0$$

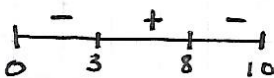
$$x = 5$$



g is dec on $(0, 5)$

$$g''(x) = f'(x) = 0$$

$$x = 3 \text{ \& } x = 8$$



g is concave up on $(3, 8)$

g is decreasing &
concave up on $(3, 5)$
b/c $g'' > 0$ & $g' < 0$.

$$d) h = 2f\left(\frac{x}{2}\right) \quad h'(x) = f'\left(\frac{x}{2}\right)$$

$$L = \int_0^{20} \sqrt{1 + [f'(\frac{x}{2})]^2} dx$$

$$L = 2 \int_0^{10} \sqrt{1 + [f'(u)]^2} du$$

$$= 2(11 + 18) = \boxed{58}$$

$$u = \frac{x}{2}$$

$$u(0) = 0$$

$$du = \frac{1}{2} dx$$

$$u(20) = 10$$

$$2 du = dx$$