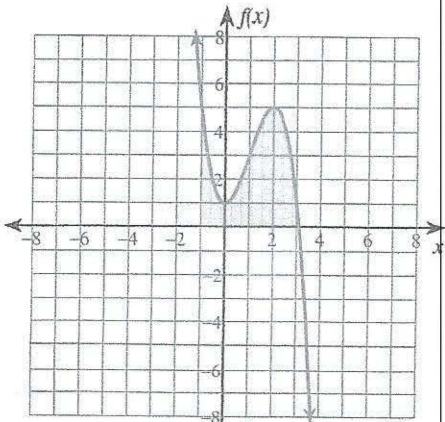


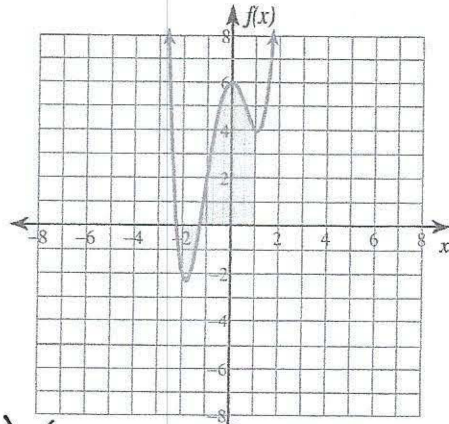
Fundamental Theorem of Calculus

Evaluate each definite integral.

1) $\int_{-1}^3 (-x^3 + 3x^2 + 1) dx$



2) $\int_{-2}^1 (x^4 + x^3 - 4x^2 + 6) dx$



$$\left[-\frac{x^4}{4} + \frac{3x^3}{3} + x \right]_{-1}^3 = \left(-\frac{81}{4} + 27 + 3 \right) - \left(-\frac{1}{4} - 1 - 1 \right)$$

$$= -\frac{81}{4} + 30 + \frac{1}{4} + 2 = -\frac{80}{4} + 32 = -20 + 32 = 12$$

$$\left[\frac{x^5}{5} + \frac{x^4}{4} - \frac{4x^3}{3} + 6x \right]_{-2}^1$$

$$\left(\frac{1}{5} + \frac{1}{4} - \frac{4}{3} + 6 \right) - \left(-\frac{32}{5} + \frac{16}{4} + \frac{32}{3} - 12 \right)$$

$$\frac{1}{5} + \frac{1}{4} - \frac{4}{3} + 6 + \frac{32}{5} - 4 - \frac{32}{3} + 12$$

$$\frac{33}{5} - \frac{36}{3} + \frac{14}{4} + \frac{1}{4} = \frac{33}{5} + 2 + \frac{1}{4} = \frac{132 + 40 + 5}{20} = \frac{177}{20}$$

3) $\int_1^3 (2x^2 - 12x + 13) dx = \left[\frac{2x^3}{3} - \frac{12x^2}{2} + 13x \right]_1^3$

$$\left(\frac{54}{3} - 54 + 39 \right) - \left(\frac{2}{3} - 6 + 13 \right)$$

$$18 - 54 + 39 - \frac{2}{3} + 6 - 13$$

$$-\frac{2}{3} - 4 = \frac{-2 - 12}{3} = \frac{-14}{3}$$

4) $\int_0^3 (-x^3 + 3x^2 - 2) dx = \left[-\frac{x^4}{4} + \frac{3x^3}{3} - 2x \right]_0^3$

$$\left(-\frac{81}{4} + 27 - 6 \right) - (0)$$

$$-\frac{81}{4} + 21 = \frac{-81 + 84}{4} = \frac{3}{4}$$

5) $\int_{-1}^0 (x^5 - 4x^3 + 4x + 4) dx = \left[\frac{x^6}{6} - \frac{4x^4}{4} + \frac{2x^2}{2} + 4x \right]_{-1}^0$

$$(0) - \left(\frac{1}{6} - 1 + 2 - 4 \right) = -\left(\frac{1}{6} - 3 \right) = \frac{-1 + 18}{6} = \frac{17}{6}$$

$\int_{-3}^0 \frac{1}{4} 4x^{\frac{4}{3}} dx = \left[\frac{3 \cdot 4 x^{\frac{4}{3} + 1}}{4} \right]_{-3}^0 = (0) - (3(-3)^{\frac{4}{3}})$

$$= -3(-3)^{\frac{4}{3}} \approx -12.98$$

7) $\int_0^3 f(x) dx, f(x) = \begin{cases} \frac{1}{2}x - 1, & x \leq 2 \\ x^2 - 6x + 8, & x > 2 \end{cases}$

$$\int_0^2 \left(\frac{1}{2}x - 1 \right) dx + \int_2^3 (x^2 - 6x + 8) dx$$

$$\left[\frac{1}{4}x^2 - x \right]_0^2 + \left[\frac{x^3}{3} - \frac{6x^2}{2} + 8x \right]_2^3$$

$$\left[(1 - 2) - (0) \right] + \left[(9 - 27 + 24) - \left(\frac{8}{3} - 12 + 16 \right) \right]$$

$$-1 + 6 - \frac{8}{3} - 4 = 1 - \frac{8}{3} = \frac{3}{3} - \frac{8}{3} = \frac{-5}{3}$$