

Integration:

$$1. \int (x^2 - 4x - 3) dx = \int x^2 dx - 4 \int x dx - 3 \int dx = \frac{x^3}{3} - 4 \frac{x^2}{2} - 3x = \frac{x^3}{3} - 2x^2 - 3x + c$$

$$2. \int (5 + x - 6x^2) dx = \int 5 dx + \int x dx - 6 \int x^2 dx = 5x + \frac{x^2}{2} - 6 \frac{x^3}{3} = 5x + \frac{x^2}{2} - 2x^3 + c$$

$$3. \int (8x^3 + 3x - 1) dx = 8 \int x^3 dx + 3 \int x dx - \int dx = 8 \frac{x^4}{4} + 3 \frac{x^2}{2} - x = 2x^4 + \frac{3}{2} x^2 - x + c$$

$$4. \int (w^4 - 2w^3) dw = \int w^4 dw - 2 \int w^3 dw = \frac{w^5}{5} - 2 \frac{w^4}{4} = \frac{w^5}{5} - \frac{w^4}{2} + c$$

$$5. \int dx = x + c$$

$$6. \int 8 dx = 8 \int dx = 8x + c$$

$$7. \int \frac{5}{8x^6} dx = \frac{5}{8} \int x^{-6} dx = \frac{5}{8} \cdot \frac{x^{-5}}{-5} = -\frac{1}{8} x^{-5} + c$$

$$8. \int \sqrt{16x^5} dx = \int 4\sqrt{x^5} dx = 4 \int x^{\frac{5}{2}} dx = 4 \cdot \frac{x^{\frac{7}{2}}}{\frac{7}{2}} = \frac{8}{7} x^{\frac{7}{2}} + c$$

$$9. \int \frac{t-3}{\sqrt{t}} dx = \int \frac{t}{\sqrt{t}} dt - 3 \int \frac{1}{\sqrt{t}} dt = \int \frac{t}{t^{\frac{1}{2}}} dt - 3 \int \frac{1}{t^{\frac{1}{2}}} dt = \int t^{\frac{1}{2}} dt - 3 \int t^{-\frac{1}{2}} dt = \frac{t^{\frac{3}{2}}}{\frac{3}{2}} - 3 \frac{t^{\frac{1}{2}}}{\frac{1}{2}} = \frac{2}{3} t^{\frac{3}{2}} - 6t^{\frac{1}{2}} + c$$

$$10. \int \frac{2s-7}{s^3} ds = 2 \int \frac{s}{s^3} ds - 7 \int \frac{1}{s^3} ds = 2 \int s^{-2} ds - 7 \int s^{-3} ds = 2 \cdot \frac{s^{-1}}{-1} - 7 \frac{s^{-2}}{-2} = -2s^{-1} + \frac{7}{2} s^{-2} + c$$

$$11. \int (\sqrt[3]{s^2} + 2) ds = \int \sqrt[3]{s^2} ds + 2 \int ds = \int s^{\frac{2}{3}} ds + 2 \int ds = \frac{s^{\frac{5}{3}}}{\frac{5}{3}} + 2s = \frac{3}{5} s^{\frac{5}{3}} + 2s + c$$

$$12. \int t^2 (\sqrt[3]{t} - \sqrt{t}) dt = \int t^2 \left( t^{\frac{1}{3}} - t^{\frac{1}{2}} \right) dt = \int \left( t^{\frac{7}{3}} - t^{\frac{5}{2}} \right) dt = \int t^{\frac{7}{3}} dt - \int t^{\frac{5}{2}} dt = \frac{t^{\frac{10}{3}}}{\frac{10}{3}} - \frac{t^{\frac{7}{2}}}{\frac{7}{2}} = \frac{3}{10} t^{\frac{10}{3}} - \frac{2}{7} t^{\frac{7}{2}} + c$$

$$13. \int (2x+3)(5x-1)dx = \int (10x^2 + 13x - 3)dx = 10 \int x^2 dx + 13 \int x dx - 3 \int dx =$$

$$10 \cdot \frac{x^3}{3} + 13 \cdot \frac{x^2}{2} - 3x = \frac{10}{3}x^3 + \frac{13}{2}x^2 - 3x + c$$

$$14. \int (x^2 + 1)^2 dx = \int (x^4 + 2x^2 + 1)dx = \int x^4 dx + 2 \int x^2 dx + \int dx = \frac{x^5}{5} + 2 \cdot \frac{x^3}{3} + x = \frac{x^5}{5} + \frac{2}{3}x^3 + x + c$$

$$15. \int \frac{x^2 - 1}{x - 1} dx = \int \frac{(x+1)(x-1)}{(x-1)} dx = \int (x+1)dx = \int x dx + \int dx = \frac{x^2}{2} + x + c$$

$$16. \int \frac{x^3 + 8}{x + 2} dx = \int \frac{(x+2)(x^2 - 2x + 4)}{(x+2)} dx = \int (x^2 - 2x + 4)dx = \int x^2 dx - 2 \int x dx + 4 \int dx =$$

$$\frac{x^3}{3} - 2 \cdot \frac{x^2}{2} + 4x = \frac{x^3}{3} - x^2 + 4x + c$$

$$17. \int (4u^{-5} + 6u^{-4})du = 4 \int u^{-5} du + 6 \int u^{-4} du = 4 \cdot \frac{u^{-4}}{-4} + 6 \cdot \frac{u^{-3}}{-3} = -u^{-4} - 2u^{-3} + c$$

$$18. \int \frac{2x^3 - 4x^2 + 5}{x^2} dx = 2 \int \frac{x^3}{x^2} dx - 4 \int \frac{x^2}{x^2} dx + 5 \int \frac{1}{x^2} dx = 2 \int x dx - 4 \int dx + 5 \int x^{-2} dx =$$

$$2 \cdot \frac{x^2}{2} - 4x + 5 \cdot \frac{x^{-1}}{-1} = x^2 - 4x - 5x^{-1} + c$$

$$19. \int (x+1)(x-2)(x+3)dx = \int (x^3 + 2x^2 - 5x - 6)dx = \int x^3 dx + 2 \int x^2 dx - 5 \int x dx - 6 \int dx =$$

$$\frac{x^4}{4} + 2 \cdot \frac{x^3}{3} - 5 \cdot \frac{x^2}{2} - 6x = \frac{x^4}{4} + \frac{2}{3}x^3 - \frac{5}{2}x^2 - 6x + c$$

$$20. \int \cos\left(\frac{x}{3}\right) dx = 3 \int \cos u du = 3 \sin u = 3 \sin\left(\frac{x}{3}\right) + c$$

$$u = \frac{x}{3} \Rightarrow du = \frac{1}{3} dx \Rightarrow 3 du = dx$$

$$\int (1 - \cos 4t) dt = \int dt - \int \cos(4t) dt = t - \frac{1}{4} \int \cos u du = t - \frac{1}{4} \sin u = t - \frac{1}{4} \sin(4t) + c$$

21.

$$u = 4t \Rightarrow du = 4 dt \Rightarrow \frac{1}{4} du = dt$$

$$\int (4 \sin 2x + 6 \cos 3x) dx = 4 \int \sin(2x) dx + 6 \int \cos(3x) dx = 4 \cdot \frac{1}{2} \int \sin u du + 6 \cdot \frac{1}{3} \int \cos v dv =$$
$$4 \cdot \frac{1}{2} (-\cos u) + 6 \cdot \frac{1}{3} (\sin v) = -2 \cos(2x) + 2 \sin(3x) + c$$

22.

$$u = 2x \Rightarrow du = 2 dx \Rightarrow \frac{1}{2} du = dx$$
$$v = 3x \Rightarrow dv = 3 dx \Rightarrow \frac{1}{3} dv = dx$$