# Indefinite Integral Exercises

1. Find the indefinite integral of the following functions with respect to $x$.

$(a)$ $x^7$

$(b)$ $4$

$(c)$ $9x^8$

$(d)$ $x^2 - 2$

$(e)$ $2x^3 - 3x^2$

$(f)$ $x^{1/3}$

$(g)$ $2x^{-3}$

$(h)$ $\sqrt{x}$

$(i)$ $ax^{10}$

$(j)$ $x^{0.2}$

$(k)$ $\sqrt{x^3}$

$(l)$ $x + x^{-1/2}$

2. Find:

$(a)$ $\int (4x^2 - 2x)dx$

$(b)$ $\int (2x^4 - 3x^3)dx$

$(c)$ $\int (x^2 - x^{-2})dx$

$(d)$ $\int (2x + 1)^2 dx$

$(e)$ $\int (3x^2 - 2x + 1)dx$

$(f)$ $\int (x^5 - 4x^3 + x^2 - x + 1)dx$

$(g)$ $\int (x - 1)(x + 1)dx$

$(h)$ $\int \dfrac{(x^3 - 2x^2 + x)}{x} dx$

$(i)$ $\int x^2 \sqrt{x}\, dx$

$(j)$ $\int \left(3x^2 + \dfrac{2}{x^3}\right) dx$

$(k)$ $\int (x^{3/2} + x^{-3/2})dx$

$(l)$ $\int \left(\dfrac{1}{x\sqrt{x}} + x^{-1.3}\right) dx$

3. Find the following indefinite integrals.

$(a)$ $\int (12x^2 - 4)dx$

$(b)$ $\int \dfrac{2x^2 - 3x}{x} dx$

$(c)$ $\int (3t^2 - 2t + 5)dt$

$(d)$ $\int \left(\dfrac{1}{t^2} + t\right) dt$

$(i)$ $\int 2du$

$(f)$ $\int \left(2t + \dfrac{1}{t}\right) dt$

$(g)$ $\int \left(x^2 - \sqrt{x}\right)^2 dx$

$(j)$ $\int \dfrac{v^2 - 4}{v - 2} dv$

$(e)$ $\int 2u^2(4u^3 + 3u^2 - 1)du$

$(h)$ $\int \left(x + \dfrac{1}{x}\right)\left(x - \dfrac{1}{x}\right) dx$

$(k)$ $\int \left(\dfrac{3x^4 + 1}{x^2}\right) dx$

$(l)$ $\int (1 - \sqrt{u})(3 + 2u)du$

4. If $\dfrac{dy}{dx} = 3(x^2 - 1)$, find a general solution for $y$. If $y = 1$ when $x = 1$, what is the numerical value of the constant of integration?

5. The gradient of a curve is given by $\dfrac{dy}{dx} = 2x - 3$. Find the equation of the curve if:

$(a)$ it passes through the origin.

$(b)$ it passes through $(1, -2)$.

$(c)$ it passes through $(1, 2)$.

6. If $\dfrac{dy}{dx} = x^2 - 5x + 1$ and when $x = 1$, $y = 0$, what is the value of $y$ when $x = 4$?

7.  Verify that:

$(a) \displaystyle\int x\sqrt{x}\,dx \neq \int x\,dx \cdot \int \sqrt{x}\,dx$

$(b) \displaystyle\int x(x+1)\,dx \neq x \cdot \int (x+1)\,dx$

## Answers:

1. $(a)\ \dfrac{x^8}{8} + C$     $(d)\ \dfrac{x^3}{3} - 2x + C$     $(g)\ -x^{-2} + C$     $(j)\ \dfrac{x^{1.2}}{1.2} + C$

   $(b)\ 4x + C$     $(e)\ \dfrac{x^4}{2} - x^3 + C$     $(h)\ \dfrac{2}{3}x^{3/2} + C$     $(k)\ \dfrac{2}{5}x^{5/2} + C$

   $(c)\ x^9 + C$     $(f)\ \dfrac{3}{4}x^{4/3} + C$     $(i)\ \dfrac{ax^{11}}{11} + C$     $(l)\ \dfrac{x^2}{2} + 2x^{1/2} + C$

2. $(a)\ \dfrac{4x^3}{3} - x^2 + C$     $(e)\ x^3 - x^2 + x + C$     $(i)\ \dfrac{2}{7}x^{7/2} + C$

   $(b)\ \dfrac{2x^5}{5} + \dfrac{3x^4}{4} + C$     $(f)\ \dfrac{x^6}{6} - x^4 + \dfrac{x^3}{3} + \dfrac{x^2}{2} + x + C$     $(j)\ x^3 - \dfrac{1}{x^2} + C$

   $(c)\ \dfrac{x^3}{3} + x^{-1} + C$     $(g)\ \dfrac{x^3}{3} - x + C$     $(k)\ \dfrac{2}{5}x^{5/2} - 2x^{-1/2} + C$

   $(d)\ \dfrac{4x^3}{3} + 2x^2 + x + C$     $(h)\ \dfrac{x^3}{3} + x^2 + x + C$     $(l)\ -\dfrac{2}{\sqrt{x}} - \dfrac{x^{-0.3}}{0.3} + C$

3. $(a)\ 4x(x^2 - 1) + C$     $(i)\ 2u + C$     $(e)\ \dfrac{4u^6}{3} + \dfrac{6u^5}{5} - \dfrac{2u^5}{2} + C$

   $(b)\ x^2 - 3x + C$     $(f)\ \dfrac{4t^3}{3} + 4t - \dfrac{1}{t} + C$     $(h)\ \dfrac{x^3}{3} + \dfrac{1}{x} + C$

   $(c)\ t^3 - t^2 + 5t + C$     $(g)\ \dfrac{x^5}{5} - \dfrac{4}{7}x^{7/2} + \dfrac{x^2}{2} + C$     $(k)\ x^3 - \dfrac{1}{x} + C$

   $(d)\ \dfrac{t^2}{2} - \dfrac{1}{t} + C$     $(j)\ \dfrac{v^2}{2} + 2v + C$     $(l)\ u^2 + 3u - 2u^{3/2} - \dfrac{4}{5}u^{5/2} + C$

4. $y = x^3 - 3x + C$
   $C = 3$

5. $(a)\ y = x^2 - 3x$
   $(b)\ y = x^2 - 3x$
   $(c)\ y = x^2 - 3x + 4$

6. $-4\frac{1}{2}$