

Questions

Example Find the general indefinite integral. Illustrate by graphing several members of the family on the same screen.

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

Example Evaluate the integral $\int_0^4 (2v + 5)(3v - 1) dv$.

Example Evaluate the integral $\int_0^{3\pi/2} |\sin x| dx$.

Solutions

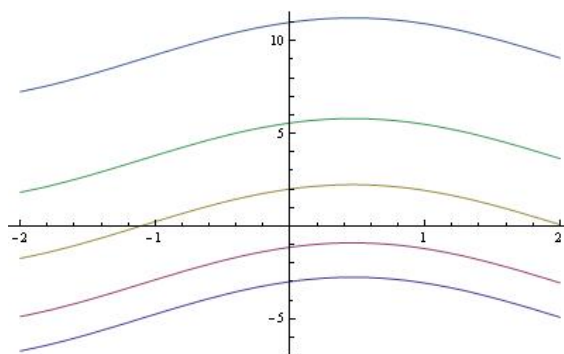
Example Find the general indefinite integral. Illustrate by graphing several members of the family on the same screen.

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

$$\begin{aligned} \int (\cos x - 2 \sin x) dx &= \sin x - 2(-\cos x) + C \\ &= \sin x + 2 \cos x + C \end{aligned}$$

Here is a sketch of the family of curves.

```
Clear[y]
y[c_] := 2 Cos[x] + Sin[x] + c
Plot[{y[-5], y[-Pi], y[0], y[3.567], y[9]}, {x, -2, 2}]
```



Notice that *Mathematica* doesn't label the axes for you.

Example Evaluate the integral $\int_0^4 (2v + 5)(3v - 1) dv$.

$$\begin{aligned}
 \int_0^4 (2v + 5)(3v - 1) dv &= \int_0^4 (6v^2 + 15v - 2v - 5) dv \\
 &= \int_0^4 (6v^2 + 13v - 5) dv \\
 &= \left(\frac{6}{3}v^3 + \frac{13}{2}v^2 - 5v \right)_0^4 \\
 &= \left(2v^3 + \frac{13}{2}v^2 - 5v \right)_0^4 \\
 &= \left(2(4)^3 + \frac{13}{2}(4)^2 - 5(4) \right) - \left(2(0)^3 + \frac{13}{2}(0)^2 - 5(0) \right) \\
 &= (128 + 104 - 20) = 212
 \end{aligned}$$

Example Evaluate the integral $\int_0^{3\pi/2} |\sin x| dx$.

Since this is an absolute value function, we must deal with that aspect first. This will be a piecewise defined function.

$$f(x) = |\sin x| = \begin{cases} \sin x & 0 < x < \pi \\ -\sin x & \pi < x < 3\pi/2 \end{cases}$$

$$\begin{aligned}
 \int_0^{3\pi/2} f(x) dx &= \int_0^{\pi} f(x) dx + \int_{\pi}^{3\pi/2} f(x) dx \\
 &= \int_0^{\pi} \sin x dx + \int_{\pi}^{3\pi/2} (-\sin x) dx \\
 &= \int_0^{\pi} \sin x dx - \int_{\pi}^{3\pi/2} \sin x dx \\
 &= -\cos x \Big|_0^{\pi} - (-\cos x) \Big|_{\pi}^{3\pi/2} \\
 &= -\cos x \Big|_0^{\pi} + \cos x \Big|_{\pi}^{3\pi/2} \\
 &= -\cos \pi + \cos 0 + \cos 3\pi/2 - \cos \pi \\
 &= -(-1) + (1) + 0 - (-1) \\
 &= 3
 \end{aligned}$$