# Initial-value problems

6 questions | 18 marks

Equivalent correct methods earn the corresponding marks.

**1.** $F'(x) = 6x$ and $F(0) = 3$. Find $F$. [3 marks]

$F = 3x^2 + C$; at 0, $C = 3$.

**Answer:** $F = 3x^2 + 3$

**2.** $y' = 4x^3$ and $y(1) = 7$. Find $y$. [3 marks]

$7 = 1 + C$ gives $C = 6$.

**Answer:** $y = x^4 + 6$

**3.** $f'(x) = \cos x$ and $f(\frac{\pi}{2}) = 4$. Find $f$. [3 marks]

Integrate to $\sin x + C$; $4 = 1 + C$.

**Answer:** $f(x) = \sin x + 3$

**4.** $g'(x) = \frac{2}{x}$ for $x > 0$ and $g(1) = 5$. Find $g$. [3 marks]

$\ln 1 = 0$, so $C = 5$.

**Answer:** $g(x) = 2\ln x + 5$

**5.** A particle has acceleration $a(t) = 6t$ m/s² and initial velocity 2 m/s. Find its velocity at $t = 3$ s. [3 marks]

$v(t) = 3t^2 + C$.

Use $v(0) = 2$ to obtain $C = 2$, then $v(3) = 29$.

**Answer:** $29$ m/s

**6.** A quantity satisfies $N'(t) = 3e^t$ and $N(0) = 8$. Find $N(\ln 2)$. [3 marks]

$N = 3e^t + 5$.

$N(\ln 2) = 3(2) + 5 = 11$.

**Answer:** $11$