7.1) First-order differential equations

Worked example	Your turn
Find general solutions to: $$\frac{dy}{dx} = 2$$	Find the general solution to: $$\frac{dy}{dx} = -3$$ $$y = -3x + c$$

$$\frac{dy}{dx} = -\frac{1}{2}$$

Worked example	Your turn
Find general solutions to: $$\frac{dy}{dx} = 3x^2$$	Find the general solution to: $$\frac{dy}{dx} = 2x$$ $$y = x^2 + c$$

$$\frac{dy}{dx} = 4x^3$$

Worked example	Your turn
Find general solutions to: $$\frac{dy}{dx} = \frac{4y}{x}$$	Find the general solution to: $$\frac{dy}{dx} = \frac{2y}{x}$$ $$y = Ax^2$$
$$\frac{dy}{dx} = \frac{3y}{x}$$	

Worked example	Your turn
Find general solutions to: $$\frac{dy}{dx} = \sin x$$	Find the general solution to: $$\frac{dy}{dx} = \cos x$$ $$\color{red}{y = \sin x + c}$$
$$\frac{dy}{dx} = \sec^2 x$$	

Worked example	Your turn
Find general solutions to: $$\frac{dy}{dx} = y \tan x$$	Find the general solution to: $$\frac{dy}{dx} = y \cot x, \ 0 < x < \pi$$ $$y = A \sin x$$

Worked example	Your turn
Find general solutions to: $$\frac{dy}{dx} = -\frac{x}{y}$$	Find the general solution to: $$\frac{dy}{dx} = -\frac{y}{x}$$ $$y = \pm\frac{A}{x}, \text{ where } A = e^c$$

$$\frac{dy}{dx} = \frac{x}{y}$$

Worked example	Your turn
Find general solutions to: $$\frac{dy}{dx} = xy + y$$	Find the general solution to: $$\frac{dy}{dx} = xy + x$$ $$\textcolor{red}{y = Ae^{\frac{1}{2}x^2} - 1}$$

$$\frac{dy}{dx} = xy - x$$

Worked example	Your turn
Express as the derivative of one product:	Express as the derivative of one product:
$$x^2\frac{dy}{dx} + 2xy$$	$$x^3\frac{dy}{dx} + 3x^2y$$
	$$\frac{d}{dx}(x^3y)$$
$$(\ln x)\frac{dy}{dx} + \frac{y}{x}$$	$$e^x\frac{dy}{dx} + e^xy$$
	$$\frac{d}{dx}(e^xy)$$
$$\cos(x)\frac{dy}{dx} - y\sin(x)$$	$$\sin(x)\frac{dy}{dx} + y\cos(x)$$
	$$\frac{d}{dx}(y\sin x)$$

Worked example	Your turn
Find general solutions to: $$x^4 \frac{dy}{dx} + 4x^3 y = \cos x$$	Find the general solution to: $$x^3 \frac{dy}{dx} + 3x^2 y = \sin x$$ $$y = -\frac{1}{x^3} \cos x + \frac{c}{x^3}$$

Worked example	Your turn
Find general solutions to: $$\frac{1}{x^2}\frac{dy}{dx} - \frac{2}{x^3}y = e^x$$	Find the general solution to: $$\frac{1}{x}\frac{dy}{dx} - \frac{1}{x^2}y = e^x$$ $$y = x(e^x + c)$$

Worked example	Your turn
Find general solutions to: $$8x^3y\frac{dy}{dx} + 12x^2y^2 = x^4$$	Find the general solution to: $$4xy\frac{dy}{dx} + 2y^2 = x^2$$ $$y^2 = \frac{1}{6}x^2 + \frac{c}{2x}$$