

MathQuest: Differential Equations

Separation of Variables

1. Which of the following differential equations is not separable?

- (a) $y' = 3 \sin x \cos y$
- (b) $y' = x^2 + 3y$
- (c) $y' = e^{2x+y}$
- (d) $y' = 4x + 7$
- (e) More than one of the above

2. Which of the following differential equations is not separable?

- (a) $\frac{dx}{dt} = xt^2 - 4x$
- (b) $\frac{dx}{dt} = 3x^2t^3$
- (c) $\frac{dx}{dt} = \sin(2xt)$
- (d) $\frac{dx}{dt} = t^4 \ln(5x)$

3. Which of the following differential equations is separable?

- (a) $uu' = 2x + u$
- (b) $3ux = \sin(u')$
- (c) $\frac{2x^3}{5u'+u} = 1$
- (d) $e^{2u'x^2} = e^{u^3}$

4. If we separate the variables in the differential equation $3z't = z^2$, what do we get?

- (a) $3z^{-2}dz = t^{-1}dt$
- (b) $3tdt = z^2dt$
- (c) $3z'tdz = z^2dt$
- (d) $z = \sqrt{3z't}$
- (e) This equation cannot be separated.

5. If we separate the variables in the differential equation $y' = 2y + 3$, what do we get?

- (a) $\frac{dy}{2y} = 3dx$
- (b) $dy = 2y = 3dx$
- (c) $\frac{dy}{y} = 5dx$
- (d) $\frac{dy}{2y+3} = dx$
- (e) This equation cannot be separated.

6. What is the solution to the differential equation: $\frac{dy}{dx} = 2xy$.

- (a) $y = e^{x^2} + C$
- (b) $y = Ce^{x^2}$
- (c) $y = e^{2x} + C$
- (d) $y = Ce^{2x}$

7. A plant grows at a rate that is proportional to the square root of its height $h(t)$ – use k as the constant of proportionality. If we separate the variables in the differential equation for its growth, what do we get?

- (a) $kh^{1/2}dt = dh$
- (b) $\sqrt{h}dh = kdt$
- (c) $h^{1/2}dh = kdt$
- (d) $h^{-1/2}dh = kdt$
- (e) None of the above