

1. Find the solution to $\frac{dy}{dx} = 6x^2 + 2x$ passing through the point $(-3, 12)$.

A. $y = 18x^3 + 4x^2$

B. $y = 12x + 48$

C. $y = 2x^3 + x^2 - 51$

D. $y = \frac{1}{2}x^3 + 57$

E. $y = 2x^3 + x^2 + 57$

2. The solution to $\frac{dy}{dx} = \sec x \tan x$, subject to the condition that $y = 5$ when $x = \frac{2\pi}{3}$, is

A. $y = \sec x + 7$

B. $y = \tan^2 x + 5 + \frac{2}{\sqrt{3}}$

C. $y = \sec x \tan^2 x + \sec^3 x + 19$

D. $y = \sec x + 5 + \frac{2}{\sqrt{3}}$

E. $y = \tan^2 x + 7$

3. Find the general solution of $\sin^2 t + y \sec t \frac{dy}{dt} = 0$.

A. $y^2 - \cos^2 t = C$

B. $y^2 + 2 \sin t = C$

C. $y = Ce^{\frac{1}{3} \sin t}$

D. $3y^2 + 2 \sin^3 t = C$

E. $y^2 - 2 \cos t = C$

4. Find the solution to the equation $(1 + x^3)dy - x^2y^3dx = 0$ that passes through the point $(0, \frac{1}{4})$.

A. $\frac{1}{2y^2} + \ln|1 + x^3| - 8 = 0$

B. $\frac{1}{4}y^4 - \frac{1}{3} \ln|1 + x^3| - 64 = 0$

C. $\frac{1}{4}y^4 - \frac{1}{3} \ln|1 + x^3| - \frac{1}{1024} = 0$

D. $\frac{1}{2y^2} + \frac{1}{3} \ln|1 + x^3| - 8 = 0$

E. $\frac{1}{2y^2} + \frac{1}{3} \ln|1 + x^3| - 2 = 0$

5. The general solution of the equation $4 \frac{dy}{dx} + 8y = e^{-5x}$ is

- A. $y = \frac{1}{3}e^{-5x} + C$
- B. $y = -\frac{1}{12}e^{-5x} + Ce^{-2x}$
- C. $y = -\frac{1}{12}e^{-x} + Ce^{2x}$
- D. $y = \frac{1}{3}e^{-5x} + Ce^{-8x}$
- E. $y = -\frac{1}{12}e^{-5x} + C$

6. It is found that 5% of a certain quantity of some isotope of radium decays after 25 years. Determine the half-life of this isotope. Round your answer to the nearest year.

- A. 21
- B. 6
- C. 250
- D. 1460
- E. 338

7. A body whose temperature is 22°C is placed in a freezer kept at -10°C . One minute later the temperature of the body has dropped to 18°C . How long will it take for the temperature to fall to 0°C ? Round your answer to 2 decimal places.

- A. 2.02 min
B. 32.00 min
 C. 8.71 min
D. 1.20 min
E. 18.02 min

8. Find the solution to $3\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 8y = 0$ subject to the condition that $y = -4$ and $\frac{dy}{dx} = -2$ when $x = 0$.

- A. $y = -3e^{\frac{4}{3}x} - e^{-2x}$
B. $y = -\frac{11}{5}e^{\frac{4}{3}x} - \frac{9}{5}e^{2x}$
C. $y = -e^{\frac{4}{3}x} - 3e^{-2x}$
D. $y = -9e^{\frac{4}{3}x} + 5e^{2x}$
E. $y = -\frac{9}{5}e^{\frac{4}{3}x} - \frac{11}{5}e^{-2x}$

9. Find the general solution of $\frac{d^2y}{dx^2} - 12\frac{dy}{dx} + 36y = 0$.

A. $y = c_1e^{6x} + c_2e^{-6x}$

B. $y = c_1e^{-6x} + c_2xe^{-6x} + c_3x^2e^{-6x}$

C. $y = c_1e^{6x} + c_2xe^{6x}$

D. $y = c_1e^{-6x} + c_2xe^{-6x}$

E. $y = c_1e^{6x} + c_2xe^{6x} + c_3x^2e^{6x}$

10. Find the general solution of $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 5y = 0$.

A. $y = e^{-\frac{3}{2}x} (c_1 \cos(\frac{\sqrt{11}}{2}x) + c_2 \sin(\frac{\sqrt{11}}{2}x))$

B. $y = c_1e^{-x} + c_2e^{-5x}$

C. $y = e^{3x} (c_1 \cos(\sqrt{11}x) + c_2 \sin(\sqrt{11}x))$

D. $y = e^{\frac{3}{2}x} (c_1 \cos(\frac{\sqrt{11}}{2}x) + c_2 \sin(\frac{\sqrt{11}}{2}x))$

E. $y = c_1e^{5x} + c_2e^x$

11. Solve the equation $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 6y = 4x$.

- (A) $y = c_1e^{3x} + c_2e^{-2x} - \frac{2}{3}x + \frac{1}{9}$
- B. $y = c_1e^{-2x} + c_2xe^{-2x} - \frac{3}{2}x - 1$
- C. $y = c_1e^{-3x} + c_2e^{2x} - \frac{2}{3}x + \frac{1}{9}$
- D. $y = c_1e^{3x} + c_2e^{-2x} - \frac{2}{3}x + 9$
- E. $y = c_1e^{3x} + c_2xe^{3x} - 2x + 9$

12. Solve $(D^2 - 9)y = 16 \cos x$, subject to the condition that $y = 0$ and $Dy = 3$ when $x = 0$.

- A. $y = 2e^{3x} - 2e^{-2x} + \frac{8}{5} \cos x$
- B. $y = \frac{1}{2}e^{3x} - \frac{1}{2}e^{-3x} + 2 \cos x$
- C. $y = 2e^{3x} - 2e^{-3x} + 8 \cos x$
- (D) $y = \frac{1}{2}e^{3x} - \frac{1}{2}e^{-3x} - \frac{8}{5} \cos x$
- E. $y = -\frac{1}{2}e^{3x} - \frac{1}{2}e^{3x} + 2 \cos x$