MathQuest: Differential Equations

Integrating Factors

1. If y is a function of t, which of the following is $t\left(y' + \frac{1}{t}y\right)$ equivalent to?
   (a) $[ty]'$
   (b) $\left[\frac{1}{t}y\right]'$
   (c) ty'
   (d) $\frac{1}{t}y'$
   (e) None of the above

2. Which of the following is an integrating factor for $y' + 3ty = \sin t$?
   (a) $e^{\frac{3}{2}t^2}$
   (b) e^3
   (c) $e^{\sin t}$
   (d) $e^{-\cos t}$
   (e) e^{3y}
   (f) All of the above

3. Which of the following is an integrating factor for $y' + 2y = 3t$?
   (a) e^{2t}
   (b) e^{2t+5}
   (c) $e^2 e^{2t}$
   (d) $7e^{2t}$
   (e) All of the above
   (f) None of the above

4. Which of the following is an integrating factor for $3y' + 6ty = 8t$?
   (a) e^{3t^2}
   (b) e^{t^2}

(c) e^6

(d) All of the above

(e) None of the above

(f) This problem cannot be solved with integrating factors.

5. Can integrating factors be used to solve $y' + 2ty = 1$?

   (a) Yes. The solution is $y = e^{-t^2} \int e^{t^2} dt$.

   (b) No - we cannot evaluate $\int e^{t^2} dt$.

6. The differential equation $y' + 2y = 3t$ is solved using integrating factors. The solution is $y = \frac{3}{2}t - \frac{3}{4} + Ce^{-2t}$. Which of the following statements describes the long-term behavior as $t \to \infty$?

   (a) The solutions will approach zero, because $e^{-2t} \to 0$ as $t \to \infty$.

   (b) The solutions will grow without bound because $\frac{3}{2}t \to \infty$ as $t \to \infty$.

   (c) The long-term behavior depends on the inital condition; we need to know the value of C before we can answer this.

7. Which of the following is $e^{3t}(y' + 2y)$ equivalent to?

   (a) $[e^{2t}y]'$

   (b) $[e^{3t}y]'$

   (c) $e^{3t}y'$

   (d) $e^{2t}y'$

   (e) None of the above