1. The ODE $y'' + 6y' + 9y = 0$ represents a system that is

   A. over-damped

   B. under-damped

   C. undamped

   D. critically damped

2. The function $y = e^{-2t}(C_1 \cos 3t + C_2 \sin 3t)$ is the response of a system that is

   A. over-damped

   B. under-damped

   C. undamped

   D. critically damped

3. The solution to $y'' + by' + 4y = f(t)$ will have both transient and steady-state parts if

A. $b = 0$ and $f(t) = 3\cos 5t$

B. $b = 0$ and $f(t) = 3e^{-5t}$

C. $b \neq 0$ and $f(t) = 3\cos 5t$

D. $b = 0$ and $f(t) = 3\cos 2t$

4. The solution to $y'' + by' + 4y = f(t)$ will be entirely transient if

A. $b = 0$ and $f(t) = 3\cos 5t$

B. $b = 0$ and $f(t) = 3e^{-5t}$

C. $b \neq 0$ and $f(t) = 3\cos 5t$

D. $b \neq 0$ and $f(t) = 3e^{-5t}$

5. The solution to the ODE $y'' + 6y' + 2y = 0$ will have

A. only a transient part

B. only a steady-state part

C. neither a transient part nor a steady-state part

D. both a transient and a steady-state part

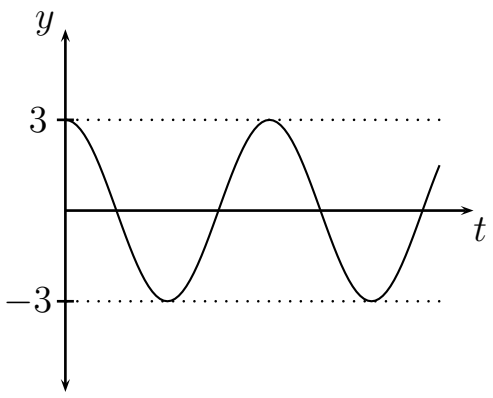
6. The solution to the ODE $y'' + 6y' + 2y = 0$ will

A. oscillate

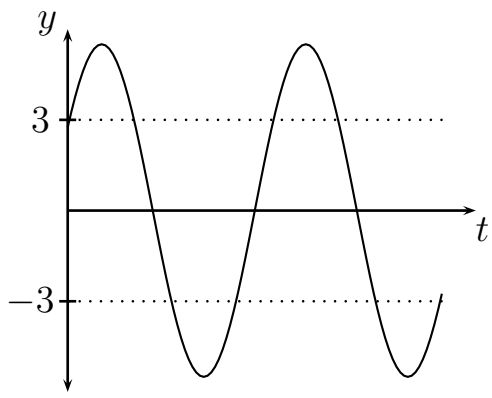
B. not oscillate

7. Which graph below represents the motion of a mass on a spring, with no damping, having initial conditions $y(0) = 3,\ y'(0) = -2$?

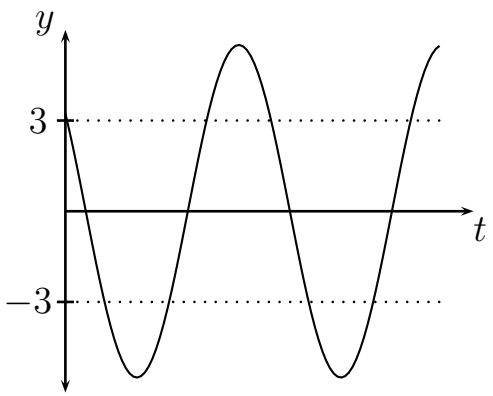
A.



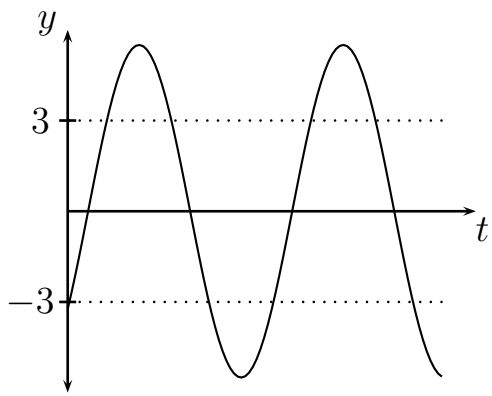
B.



C.



D.



8. Which graph above represents the motion of a mass on a spring, with no damping, having initial conditions $y(0) = 3,\ y'(0) = 0$?

9. The auxiliary equation for $y'' + 16y = 0$ has solutions $r = 4i, -4i$. The solution to the ODE is

A. $y = C_1 e^{4t} + C_2 e^{-4t}$

B. $y = C_1 e^{4t} + C_2 t e^{4t}$

C. $y = C_1 \sin 4t + C_2 \cos 4t$

D. $y = C_1 t \sin 4t + C_2 t \cos 4t$

10. The auxiliary equation for $y'' + 8y' + 16y = 0$ has only one solution, $r = -4$. The solution to the ODE is

A. $y = C_1 e^{-4t} + C_2 e^{-4t}$

B. $y = C_1 e^{-4t} + C_2 t e^{-4t}$

C. $y = C_1 e^{4t} + C_2 e^{-4t}$

D. $y = C_1 \sin 4t + C_2 \cos 4t$

11. The homogeneous solution for the ODE $y'' + 8y' + 16y = 5\sin 2t$ is $y = C_1e^{-4t} + C_2te^{-4t}$. The particular solution will have the form

A. $y = A\sin 2t$

B. $y = Ae^{-4t}$

C. $y = A\sin 2t + B\cos 2t$

D. none of these

12. The homogeneous solution to an ODE is $y = e^{-3t}(C_1\sin 2t + C_2\cos 2t)$. The solutions of the auxiliary equation are

A. $r = -3 \pm 2i$

B. $y = -3, 2$

C. $r = 2 \pm 3i$

D. none of these

13. The homogeneous solution for the ODE $y'' + 5y' + 6y = 5t^2 + 3$ is $y = C_1e^{-4t} + C_2te^{-4t}$. The particular solution will have the form

A. $y = At^2$

B. $y = At^2 + B$

C. $y = At^2 + Bt$

D. none of these

Answers:

1. D
2. B
3. B or C
4. D
5. A
6. B
7. C
8. A
9. C
10. B
11. C
12. A
13. D