

# MathQuest: Differential Equations

## Beats and Resonance

1. Which of the following forced 2nd order equations has solutions exhibiting *resonance*?

- (a)  $y'' + y = \cos(t)$
- (b)  $y'' + y = 2 \cos(t)$
- (c)  $y'' + y = -2 \cos(t)$
- (d) All of the above
- (e) None of the above

2. Which of the following forced 2nd order equations has solutions exhibiting *resonance*?

- (a)  $2y'' + y = \cos(t)$
- (b)  $2y'' + 4y = 2 \cos(2t)$
- (c)  $4y'' + y = -2 \cos(t/2)$
- (d) All of the above
- (e) None of the above

3. Which of the following forced 2nd order equations has solutions exhibiting *resonance*?

- (a)  $y'' + 2y = 10 \cos(2t)$
- (b)  $y'' + 4y = 8 \cos(2t)$
- (c)  $y'' + 2y = 6 \cos(4t)$
- (d) All of the above
- (e) None of the above

4. Which of the following forced 2nd order equations has solutions clearly exhibiting *beats*?

- (a)  $y'' + 3y = 10 \cos(2t)$
- (b)  $y'' + 1y = 2 \cos(2t)$
- (c)  $y'' + 9y = 1 \cos(3t)$
- (d) All of the above
- (e) None of the above

5. The differential equation  $y'' + 100y = 2 \cos(\omega t)$  has solutions displaying *resonance* when
- (a)  $\omega = 10,000$
  - (b)  $\omega = 10$
  - (c)  $\omega = 9$
  - (d) All of the above
  - (e) None of the above
6. The differential equation  $y'' + 100y = 2 \cos(\omega t)$  has solutions displaying *beats* when
- (a)  $\omega = 10,000$
  - (b)  $\omega = 10$
  - (c)  $\omega = 9$
  - (d) All of the above
  - (e) None of the above
7. The differential equation  $y'' + 4y = 2 \cos(2t)$  has solutions clearly displaying
- (a) beats
  - (b) damping
  - (c) resonance
  - (d) All of the above
  - (e) None of the above
8. The differential equation  $4y'' + y = 2 \cos(4t)$  has solutions clearly displaying
- (a) beats
  - (b) damping
  - (c) resonance
  - (d) All of the above
  - (e) None of the above
9. The differential equation  $4y'' + 4y = 2 \cos(t)$  has solutions clearly displaying
- (a) beats
  - (b) damping
  - (c) resonance
  - (d) All of the above
  - (e) None of the above