

Homework in place of Section 3.7

1. In each case, write the sum as $R \cos(\omega t - \delta)$

3.7.1 $3 \cos(2t) + 4 \sin(2t)$

3.7.2 $-\cos(t) + \sqrt{3} \sin(t)$

3.7.3 $4 \cos(3t) - 2 \sin(3t)$

3.7.4 $-2 \cos(\pi t) - 3 \sin(\pi t)$

2. Practice with the Model (metric system):

- (a) A spring with a 3-kg mass is held stretched 0.6 meters beyond its natural length by a force of 20 N. If the spring begins at its equilibrium position but a push gives it an initial velocity of 1.2 m/s, find the position of the mass after t seconds (assume no damping).
- (b) A spring with a 4-kg mass has a natural length of 1 meter, and is maintained stretched to a length of 1.3 m by a force of 24.3 N. If the spring is compressed to a length of 0.8 m and then released with zero velocity, find the position of the mass after t seconds (assume no damping).
- (c) A spring with a mass of 2 kg has damping constant 14 and a force of 6 N is required to keep the spring stretched 0.5 m beyond its natural length. The spring is then stretched to 1 m beyond its natural length and released. Find the position of the mass at any time t .
- (d) For the spring model with a mass of 4 kg and a spring constant of 123, find the damping constant that would produce critical damping.
- (e) Suppose we consider a mass-spring system with no damping (the damping constant is then 0), so that the differential equation expressing the motion of the mass can be modeled as

$$mu'' + ku = 0$$

Find value(s) of β so that $A \cos(\beta t)$ and $B \sin(\beta t)$ are each solutions to the homogeneous equation (for arbitrary values of A, B).