

Q: (for questions 4-10) A box of mass m is released from rest at the top of a frictionless ramp as shown. Using the coordinate system provide in the diagram:

4) What is the acceleration of the box?

- A. $\mathbf{a} = g \cos \theta \hat{\mathbf{i}}$
- B. $\mathbf{a} = g(\sin \theta \hat{\mathbf{i}} - \cos \theta \hat{\mathbf{j}})$
- C. $\mathbf{a} = g \sin \theta \hat{\mathbf{i}}$
- D. $\mathbf{a} = -g \hat{\mathbf{j}}$
- E. $\mathbf{a} = +g \hat{\mathbf{i}}$

5) What would the velocity of the box be after t seconds?

- A. $\mathbf{v} = gt \hat{\mathbf{j}}$
- B. $\mathbf{v} = gt \sin \theta \hat{\mathbf{i}}$
- C. $\mathbf{v} = gt \sin \theta \hat{\mathbf{i}} - gt \cos \theta \hat{\mathbf{j}}$
- D. $\mathbf{v} = gt \cos \theta \hat{\mathbf{i}} - gt \sin \theta \hat{\mathbf{j}}$
- E. $\mathbf{v} = gt \cos \theta \hat{\mathbf{i}}$

6) How long will it take for the box to reach the bottom of the ramp?

- A. $\frac{1}{\cos \theta} \sqrt{\frac{2h}{g}}$
- B. $\frac{\tan \theta}{1} \sqrt{\frac{2h}{g}}$
- C. $\frac{1}{\sin \theta} \sqrt{\frac{2h}{g}}$
- D. $\sqrt{\frac{2h}{g}}$

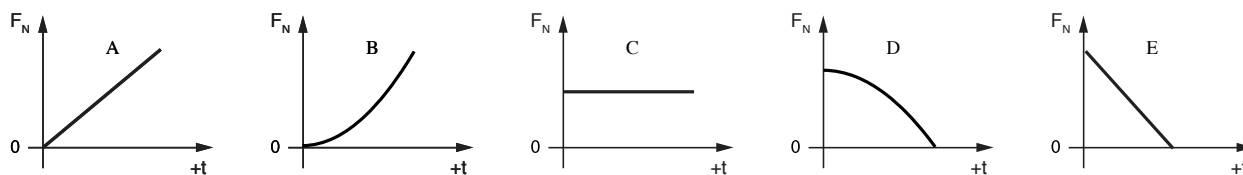
7) What will the speed of the box be when it does reach the bottom?

- A. $\sqrt{\frac{2h}{g}}$
- B. $\sqrt{\frac{2g}{h}}$
- C. $\cos \theta \sqrt{2gh}$
- D. $\sqrt{2gh}$
- E. $\sin \theta \sqrt{2gh}$

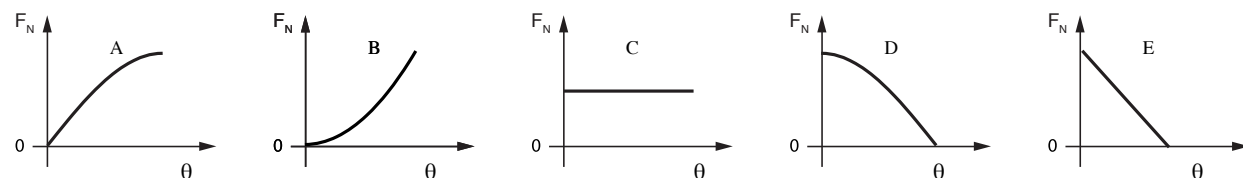
8) If the mass of the box is 2 kg, and the angle θ is 30° , what is the normal force acting on the box when it is halfway down the ramp?

- A. 17 N
- B. 9.8 N
- C. 19.6 N
- D. 3.0 N
- E. 8.5 N

9) Which graph would best portray the normal force on the box as a function of time while the box is sliding down the ramp?



10) Which graph would best portray the normal force as a function of the angle of the ramp, θ (from $0-90^\circ$)?



Multiple Choice

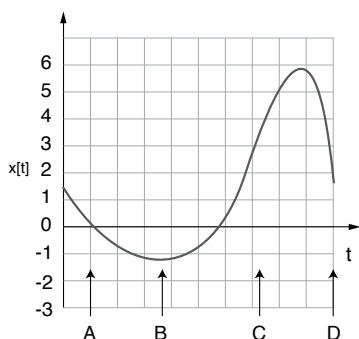
5. A bird is flying horizontally in a place where air resistance is negligible. At $t = 0$, she releases a shell she was holding in her talons and she continues flying exactly as she was before. Which of the following is not true?

- A. The bird is directly above the shell when it hits the ground.
- B. The acceleration of the shell is constant after the shell is released.
- C. The horizontal velocity of the bird equals the vertical velocity of the shell when it hits the ground
- D. The shell travels in a curved path
- E. The length of time that the shell is in the air is independent of the horizontal speed of the bird

6. Consider a projectile near the surface of the earth. At any time, its velocity will be given by:

- A. Its initial velocity minus a constant determined by g .
- B. Its initial velocity plus a constant determined by g .
- C. Its initial velocity plus an ever increasing downward velocity.
- D. Its initial velocity plus an ever increasing horizontal velocity.
- E. Only g and the time in the air are needed to know its velocity.

Below is the plot of a fly's position along the x axis as a function of time. The next three questions refer to this plot.



7. At which point in time is the fly likely to have the fastest velocity in the negative direction?

8. At which point in time is the fly likely to have the smallest speed?

9. Which statement regarding the motion of the fly is false?

- A. The fly's acceleration changes during the motion shown.
- B. The fly changes direction twice during the motion shown.
- C. The fly's displacement is roughly equal to its distance traveled.
- D. The fly is on the negative side of the origin for roughly about as long as it is on the positive.

10. A vector located in the xy plane has an x component of 4m and a y component of 10m. It is then rotated in the xy plane so its x component is doubled. Its new y component is closest to:

- A. 8.4 m
- B. 7.2 m
- C. 6.8 m
- D. 6.2 m
- E. 5.8 m

11. An object with a mass of 2 kilograms is subject to 2 forces, $\mathbf{F}_1 = +2\hat{\mathbf{i}} - 3\hat{\mathbf{j}}$ and $\mathbf{F}_2 = -4\hat{\mathbf{i}} + 2\hat{\mathbf{j}}$. Which of the following gives the magnitude of the acceleration that the object undergoes?

- A. $|\mathbf{a}| = \frac{5}{4} \text{ m/s}^2$
- B. $|\mathbf{a}| = \frac{\sqrt{5}}{2} \text{ m/s}^2$
- C. $|\mathbf{a}| = \frac{\sqrt{2}}{5} \text{ m/s}^2$
- D. $|\mathbf{a}| = \frac{4}{5} \text{ m/s}^2$
- E. $|\mathbf{a}| = 0$

Multiple Choice Answers

Enter your answers in these boxes.

5	6	7	8	9	10	11