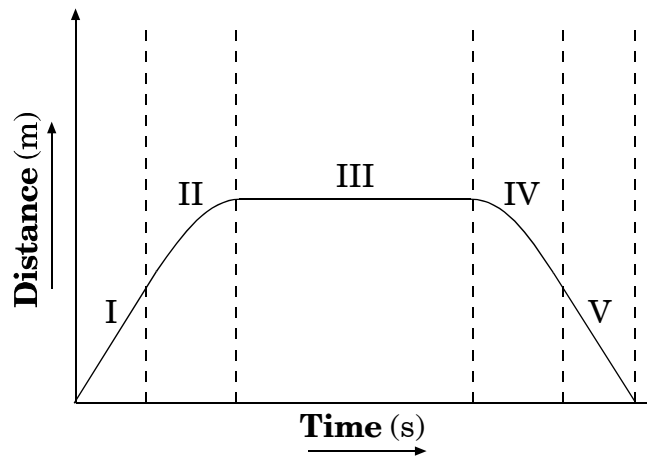1.   Consider this distance vs. time graph of an object.
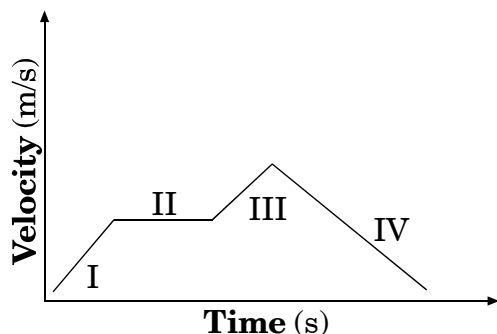
Distance vs. Time

During which intervals is the object being acted on by a force?

A   I and IV only

B   II and IV only

C   IV and V only

D   I and II only

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2. An object's velocity vs. time graph is shown below.

During which interval is there no net force acting on the object?

A   I

B   II

C   III

D   IV

3. When forces acting on an object are balanced, which characteristic of motion is zero?

A   acceleration

B   displacement

C   speed

D   velocity

4. A spaceship in deep space fires its engines for 3 seconds. Which describes its motion at the end of the 3 seconds when the engines are turned off?

A   It continues to accelerate.

B   It moves with a constant speed.

C   It moves with increasing speed, then the speed gradually decreases.

D   It gradually decreases speed.

5. A 20.0-N physics textbook rests on a table. What is the force the table exerts on the textbook?

A   0 N

B   9.80 N

C   20.0 N

D   40.0 N

6. A sign of uniform density weighing 315 N is supported by a rigid horizontal pipe of negligible mass and a cable that makes a 50.0° angle with the wall.
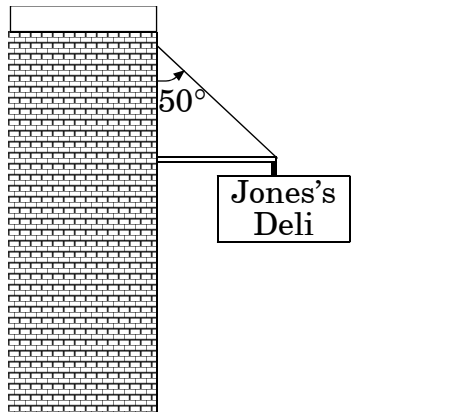
What is the tension needed for the cable to support the sign?

A   264 N

B   365 N

C   411 N

D   490. N

7. A 20-kg mass is suspended from two ropes, as shown in the diagram below.
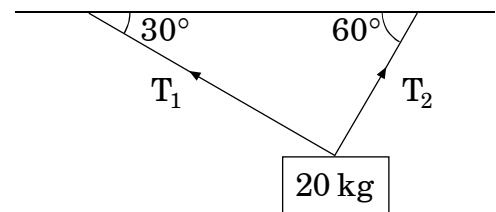
Which of the following relations is true?

A $T_1 \cos 30° = T_2 \cos 60°$

B $T_1 \sin 30° = T_2 \sin 60°$

C $T_1 \cos 30° = T_2 \sin 60°$

D $T_1 \sin 30° = T_2 \cos 60°$

8.   This graph shows weight versus mass for a group of objects on planet X.

Weight vs. Mass
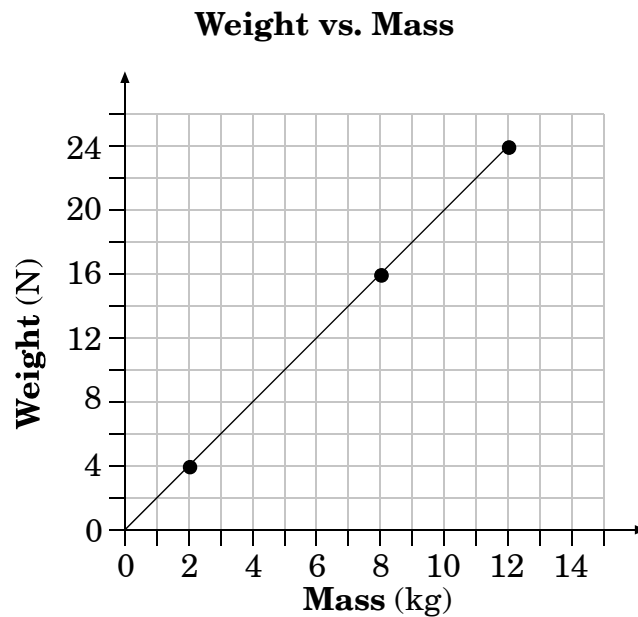
What is the acceleration due to gravity on planet X?

A   0 m/s/s

B   2 m/s/s

C   6 m/s/s

D   10 m/s/s

9.   A 45-kg object is given a net force of 500 N. What is its acceleration?

A   4.5 m/s^2

B   6.5 m/s^2

C   11 m/s^2

D   45 m/s^2

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10. In the drawing below, the identical inclines are frictionless and the mass of cart X is twice that of cart Y.
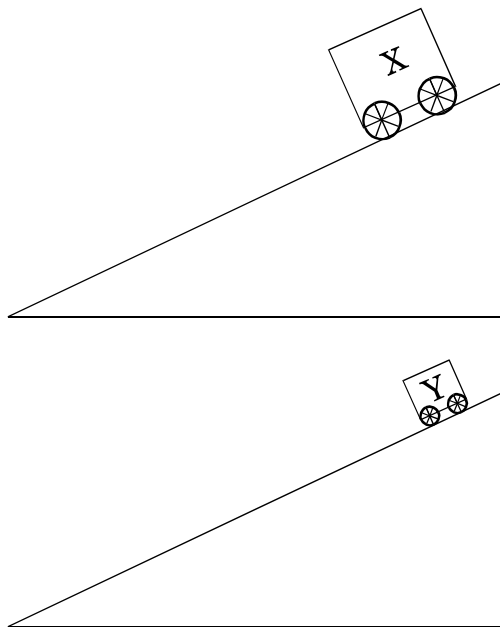
If the carts are allowed to roll down the inclines, which statement will be true?

A   The carts will reach the bottom of the inclines at the same time.

B   Cart Y will reach the bottom of the incline in half the time of cart X.

C   Cart Y will reach the bottom first but not in half the time of cart X.

D   Cart X will reach the bottom of the incline first.

11. A student is sitting at rest in a chair. How does the force that the student exerts on the chair compare to the force the chair exerts on the student?

A   the same magnitude and the same direction

B   the same magnitude but the opposite direction

C   a larger magnitude but the opposite direction

D   a smaller magnitude but the same direction

12. A student weighs 200. N. If he is in an elevator that is accelerating upward at 2.00 m/s/s, what will be his weight?

A   159 N

B   200. N

C   241 N

D   400. N

13. A physics student hits a softball with a bat. What is the force exerted on the softball by the bat?

   A   equal in both size and direction to the force exerted on the bat by the softball

   B   equal in size but opposite in direction to the force exerted on the bat by the softball

   C   opposite in direction but much smaller than the force exerted on the bat by the softball

   D   opposite in direction but much larger than the force exerted on the bat by the softball

14. A 46-kg rigid box is at rest on a horizontal floor. A 22-kg child sits on top of the box. A person pushes horizontally on the box with a force of 90. N. The force of static friction between the box and the floor is 230 N. What is the magnitude of the net force on the box?

   A   0 N

   B   140 N

   C   670 N

   D   990 N

15. The driver of a pickup truck traveling north at 20 m/s suddenly stops.
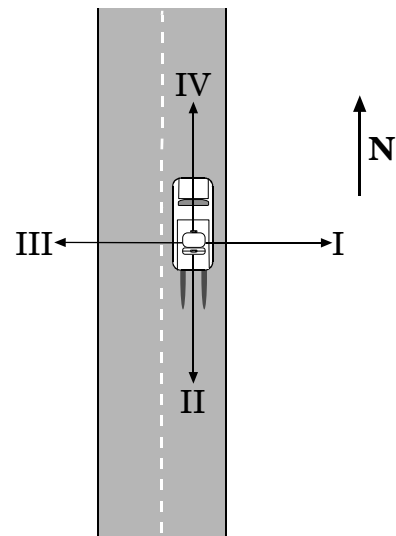
   In which direction will a suitcase lying in the center of the frictionless truck bed move?

   A   I

   B   II

   C   III

   D   IV

16. A mass is being pushed to the right at a constant velocity.
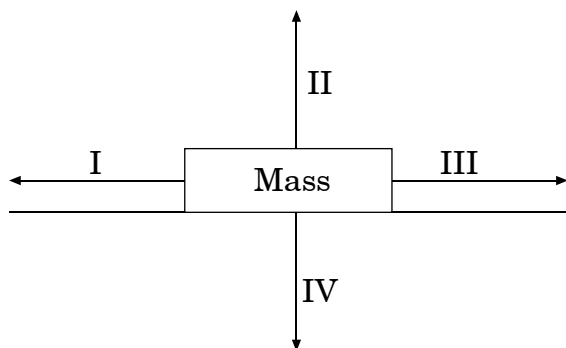
Which vector **best** represents the frictional force?

A I

B II

C III

D IV

17. At a certain distance from the center of Earth, a satellite experiences a gravitational force, F. If the mass of the satellite was doubled and placed into the same orbit, what gravitational force would the satellite have acting on it?

A $4F$

B $2F$

C $F/2$

D $F/4$

18. The mass of the sun is 1.99×10^{30} kg. The mass of Earth is 5.97×10^{24} kg. The average distance between them is 1.50×10^{11} kg. What is the gravitational attraction between Earth and the sun?

A 5.28×10^{11} N

B 3.52×10^{22} N

C 5.28×10^{33} N

D 3.52×10^{44} N

End of Goal 4 Sample Items

1   **Objective:**   **4.01**
Determine that an object will continue in its state of motion unless acted upon by a net outside force (Newton's first law of motion, The Law of Inertia).
Thinking Skill: Analyzing   **Correct Answer:**   B

2   **Objective:**   **4.01**
Determine that an object will continue in its state of motion unless acted upon by a net outside force (Newton's first law of motion, The Law of Inertia).
Thinking Skill: Analyzing   **Correct Answer:**   B

3   **Objective:**   **4.01**
Determine that an object will continue in its state of motion unless acted upon by a net outside force (Newton's first law of motion, The Law of Inertia).
Thinking Skill: Applying   **Correct Answer:**   A

4   **Objective:**   **4.01**
Determine that an object will continue in its state of motion unless acted upon by a net outside force (Newton's first law of motion, The Law of Inertia).
Thinking Skill: Applying   **Correct Answer:**   B

5   **Objective:**   **4.02**
Assess, measure and calculate the conditions required to maintain a body in a state of static equilibrium.
Thinking Skill: Applying   **Correct Answer:**   C

6   **Objective:**   **4.02**
Assess, measure and calculate the conditions required to maintain a body in a state of static equilibrium.
Thinking Skill: Analyzing   **Correct Answer:**   D

7   **Objective:**   **4.02**
Assess, measure and calculate the conditions required to maintain a body in a state of static equilibrium.
Thinking Skill: Analyzing   **Correct Answer:**   A

8   **Objective:**   **4.03**
Assess, measure, and calculate the relationship among the force acting on a body, the mass of the body, and the nature of the acceleration produced (Newton's second law of motion).
Thinking Skill: Analyzing   **Correct Answer:**   B

9   **Objective:**   **4.03**
            Assess, measure, and calculate the relationship among the force acting on a body, the
            mass of the body, and the nature of the acceleration produced (Newton's second law of
            motion).
            Thinking Skill: Applying   **Correct Answer:**   C

10   **Objective:**   **4.03**
            Assess, measure, and calculate the relationship among the force acting on a body, the
            mass of the body, and the nature of the acceleration produced (Newton's second law of
            motion).
            Thinking Skill: Organizing   **Correct Answer:**   A

11   **Objective:**   **4.04**
            Analyze and mathematically describe forces as interactions between bodies (Newton's
            third law of motion).
            Thinking Skill: Analyzing   **Correct Answer:**   B

12   **Objective:**   **4.04**
            Analyze and mathematically describe forces as interactions between bodies (Newton's
            third law of motion).
            Thinking Skill: Analyzing   **Correct Answer:**   C

13   **Objective:**   **4.04**
            Analyze and mathematically describe forces as interactions between bodies (Newton's
            third law of motion).
            Thinking Skill: Analyzing   **Correct Answer:**   B

14   **Objective:**   **4.06**
            Investigate, measure, and analyze the nature and magnitude of frictional forces.
            Thinking Skill: Analyzing   **Correct Answer:**   A

15   **Objective:**   **4.06**
            Investigate, measure, and analyze the nature and magnitude of frictional forces.
            Thinking Skill: Analyzing   **Correct Answer:**   D

16   **Objective:**   **4.06**
            Investigate, measure, and analyze the nature and magnitude of frictional forces.
            Thinking Skill: Analyzing   **Correct Answer:**   A

17   **Objective: 4.07**
Assess and calculate the nature and magnitude of gravitational forces (Newton's law of universal gravitation). (Approximately half of the items conceptual and half computational)
Thinking Skill: Applying   **Correct Answer:**   B

18   **Objective: 4.07**
Assess and calculate the nature and magnitude of gravitational forces (Newton's law of universal gravitation). (Approximately half of the items conceptual and half computational)
Thinking Skill: Applying   **Correct Answer:**   B