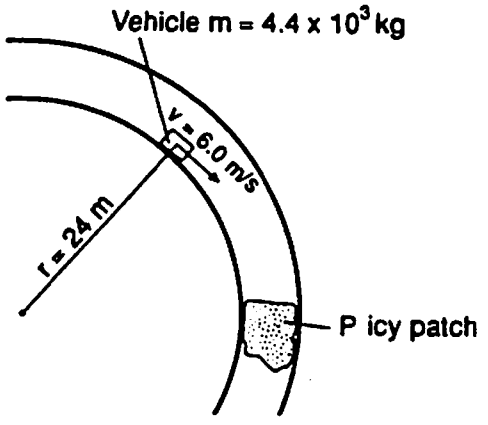
Name _____

Regents Review

Motion in a Plane #1

Base your answers to questions 1 and 2 on the information and diagram below.

A vehicle travels at a constant speed of 6.0 meters per second around a horizontal circular curve with a radius of 24 meters. The mass of the vehicle is 4.4×10^3 kilograms. An icy patch is located at *P* on the curve.



1. What is the magnitude of the frictional force that keeps the vehicle on its circular path?

(1) 1.1×10^3 N
(2) 6.6×10^3 N
(3) 4.3×10^4 N
(4) 6.5×10^4 N

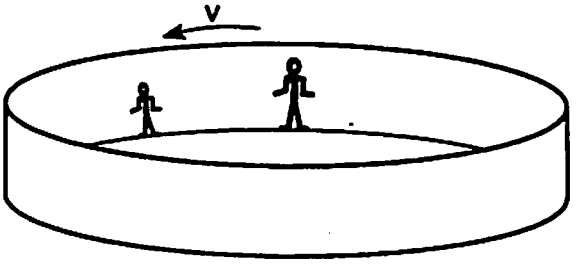
2. On the icy patch of pavement, the frictional force on the vehicle is zero. Which arrow best represents the direction of the vehicle's velocity when it reaches icy patch *P*?

(1) →
(2) ←
(3) ↑
(4) ↓

_____

Base your answers to questions 3 and 4 on the information and diagram below.

A 60.-kilogram adult and a 30.-kilogram child are passengers on a rotor ride at an amusement park. When the rotating hollow cylinder reaches a certain constant speed, *v*, the floor moves downward. Both passengers stay "pinned" against the wall of the rotor, as shown in the diagram below.



3. The magnitude of the frictional force between the adult and the wall of the spinning rotor is *F*. What is the magnitude of the frictional force between the child and the wall of the spinning rotor?

(1) F
(2) $2F$
(3) $\frac{F}{2}$
(4) $\frac{F}{4}$

Note that question has only three choices.

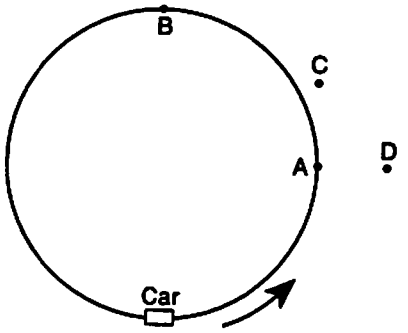
4. Compared to the magnitude of the acceleration of the adult, the magnitude of the acceleration of the child is

1 less
2 greater
3 the same

_____

MP#.

5. A convertible car with its top down is traveling at constant speed around a circular track, as shown in the diagram below.



When the car is at point *A*, if a passenger in the car throws a ball straight up, the ball could land at point

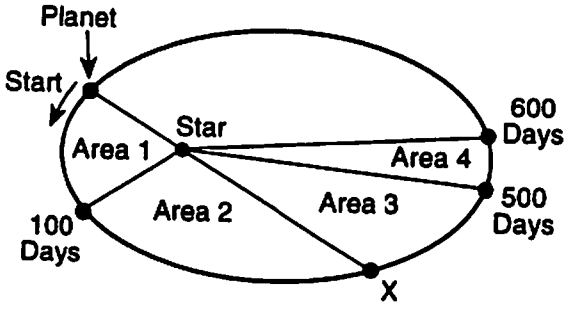
(1) *A*
(2) *B*
(3) *C*
(4) *D*

6. The comet Hyakutake, seen in the Earth's sky this year, will take more than 10,000 years to complete its orbit. Which object is at a focus of the comet's orbit?

1 Earth
2 Sun
3 Moon
4 Jupiter

7. The diagram below represents the path of a planet moving in an elliptical orbit around a star. The orbital period of the planet is 1,000 days.

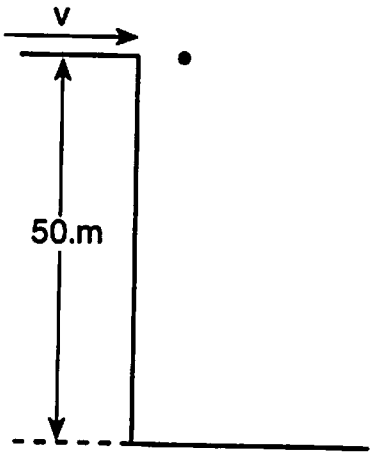
Area 1 + Area 2 = Area 3 + Area 4



According to Kepler's laws, how many days are required for the planet to travel from the starting point to point *X*?

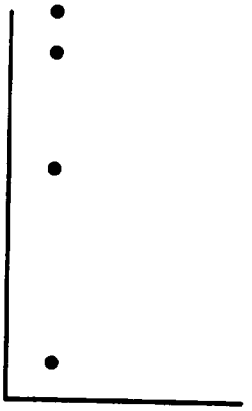
(1) 400
(2) 350
(3) 300
(4) 250

8. A ball is projected horizontally to the right from a height of 50. meters, as shown in the diagram below.

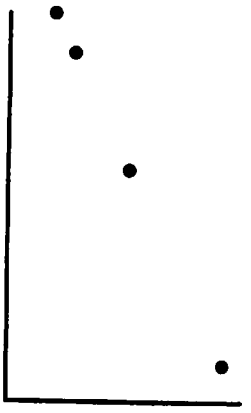


Which diagram best represents the position of the ball at 1.0-second intervals? [Neglect air resistance.]

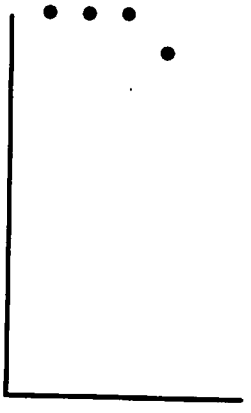
(1)



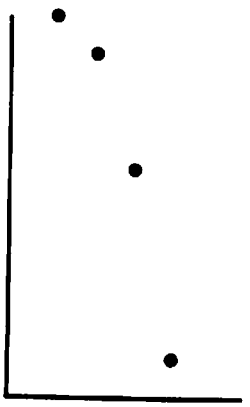
(3)



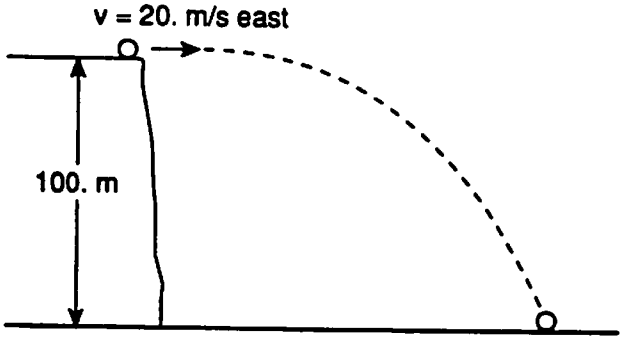
(2)



(4)



Base your answers to questions 9 and 10 on the diagram below which shows a ball projected horizontally with an initial velocity of 20. meters per second east, off a cliff 100. meters high. [Neglect air resistance.]



9. How many seconds does the ball take to reach the ground?

(1) 4.5 s
(2) 20. s
(3) 9.8 s
(4) 2.0 s

10. During the flight of the ball, what is the direction of its acceleration?

1 downward
2 upward
3 westward
4 eastward

11. A projectile is fired at an angle of 53° to the horizontal with a speed of 80. meters per second. What is the vertical component of the projectile's initial velocity?

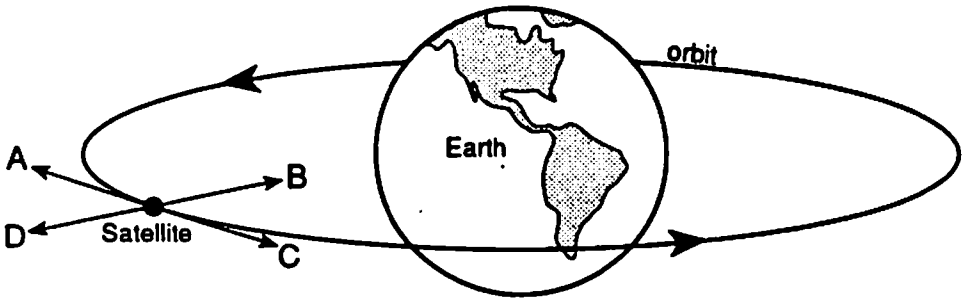
(1) 130 m/s
(2) 100 m/s
(3) 64 m/s
(4) 48 m/s

Note that question 12 has only three choices.

12. As the distance between the Moon and Earth increases, the Moon's orbital speed

1 decreases
2 increases
3 remains the same

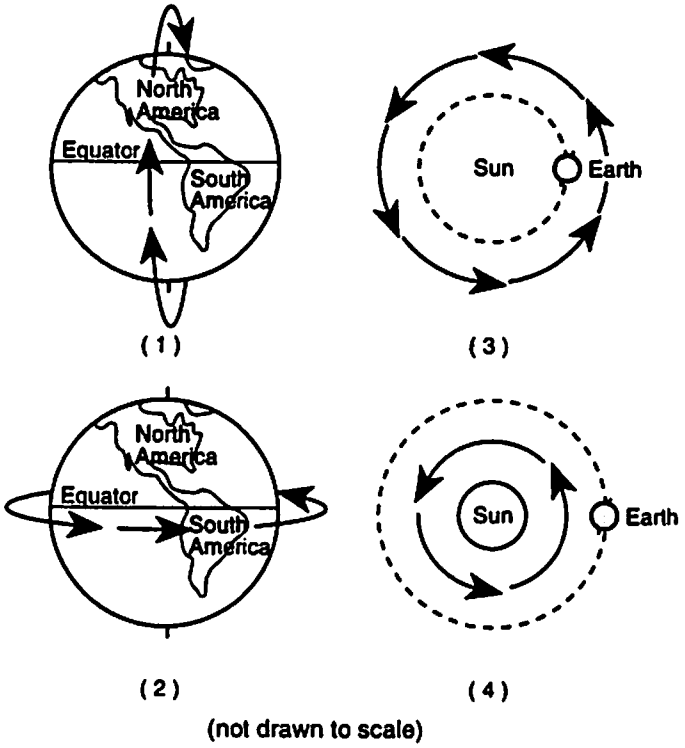
13. A satellite is moving at constant speed in a circular orbit about the Earth, as shown in the diagram below.



The net force acting on the satellite is directed toward point

(1) *A*
(2) *B*
(3) *C*
(4) *D*

14. In which diagram do the arrows best represent the path of a satellite in a geosynchronous orbit?

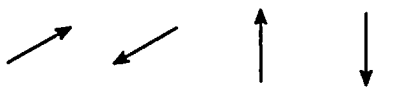


(1) (3)

(2) (4)

(not drawn to scale)

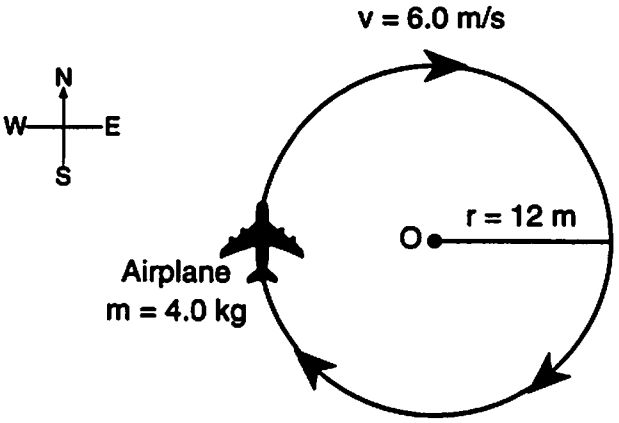
15. A soccer ball travels the path shown in the diagram at the right. Which vector best represents the direction of the force of air friction on the ball at point *P*?



(1) (2) (3) (4)

Base your answers to questions 16 through 17 on the information and diagram below.

A 4.0-kilogram model airplane travels in a horizontal circular path of radius 12 meters at a constant speed of 6.0 meters per second.



16. At the position shown, what is the direction of the net force acting on the airplane?

1 north
2 south
3 east
4 west

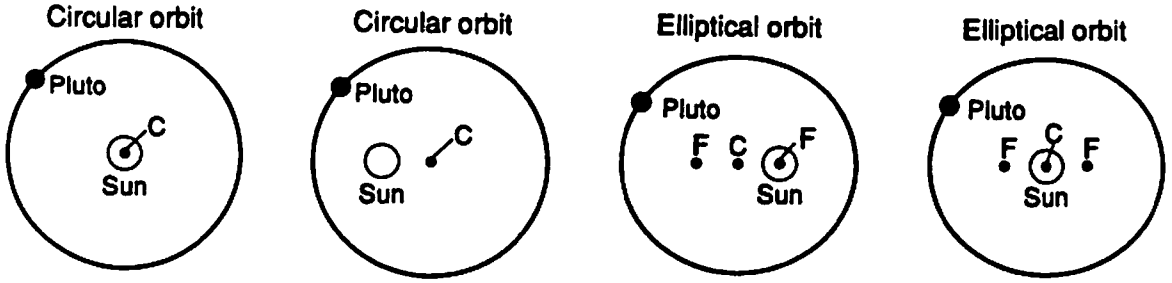
17 What is the magnitude of the centripetal acceleration of the airplane?

(1) 0.50 m/s^2
(2) 2.0 m/s^2
(3) 3.0 m/s^2
(4) 12 m/s^2

18 Which diagram best represents the orbit of the planet Pluto around the Sun?

Key:
C = Center of orbit
F = Focus

(not drawn to scale)

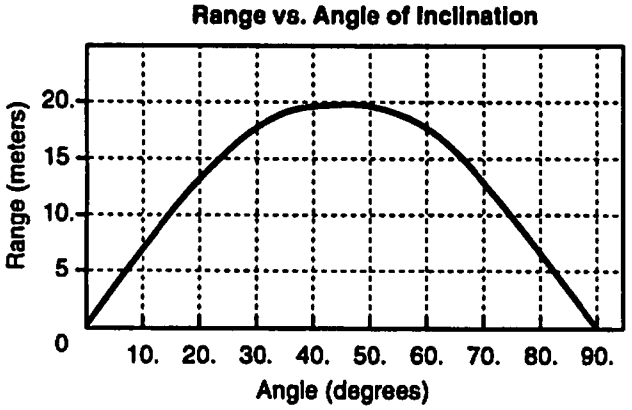


(1) (2) (3) (4)

19. A baseball player throws a baseball at a speed of 40. meters per second at an angle of 30.° to the ground. The horizontal component of the baseball's speed is approximately

(1) 15 m/s
(2) 20. m/s
(3) 30. m/s
(4) 35 m/s

20. Projectiles are fired from different angles with the same initial speed of 14 meters per second. The graph below shows the range of the projectiles as a function of the original angle of inclination to the ground, neglecting air resistance.



The graph shows that the range of the projectiles is

1 the same for all angles
2 the same for angles of 20.° and 80.°
3 greatest for an angle of 45°
4 greatest for an angle of 90.°

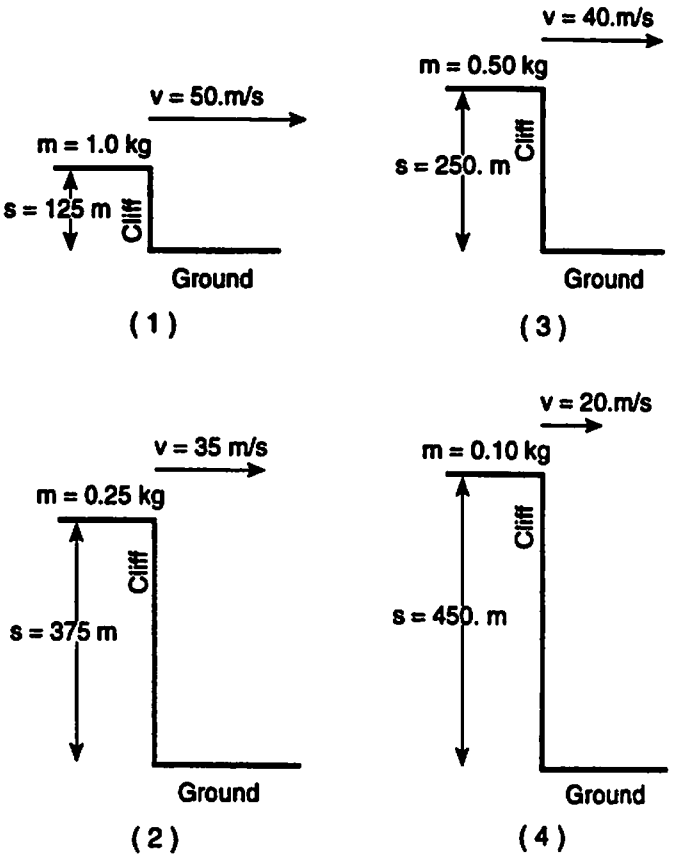
21. The data table below gives the mean radius of orbit (R) and the period (T) of some planets orbiting the Sun.

Planet	Mean Radius of Orbit (R) ($\times 10^6$ kilometers)	Orbital Period (T) (days)
Mercury	58	88
Venus	108	225
Earth	150.	365
Mars	228	687

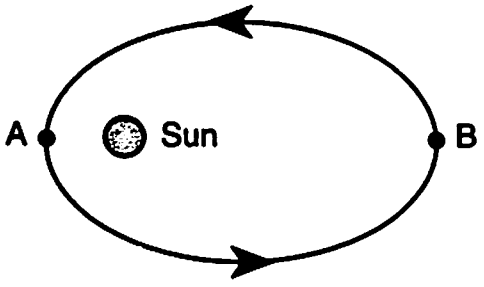
Which ratio is constant for these planets?

(1) $\frac{R}{T}$
(2) $\frac{R^2}{T}$
(3) $\frac{R^2}{T^2}$
(4) $\frac{R^3}{T^2}$

22. Four different balls are thrown horizontally off the top of four cliffs. In which diagram does the ball have the shortest time of flight?



23. The diagram below represents the path of a planet in an elliptical orbit around the Sun.



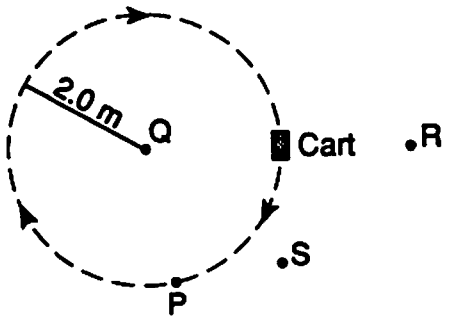
As the planet moves from point A to point B, what changes occur in its speed and kinetic energy?

1 Both speed and kinetic energy decrease.
2 Both speed and kinetic energy increase.
3 Speed decreases and kinetic energy increases.
4 Speed increases and kinetic energy decreases.

M.P #4

Base your answers to questions 24 through 27 on the information and diagram below.

The diagram shows a 5.0-kilogram cart traveling clockwise in a horizontal circle of radius 2.0 meters at a constant speed of 4.0 meters per second.



24. At the position shown, the velocity of the cart is directed toward point
(1) *P* (3) *R*
(2) *Q* (4) *S*

25. At the position shown, the centripetal acceleration of the cart is directed toward point
(1) *P* (3) *R*
(2) *Q* (4) *S*

26 If the mass of the cart was doubled, the magnitude of the centripetal acceleration of the cart would be
1 unchanged 3 halved
2 doubled 4 quadrupled

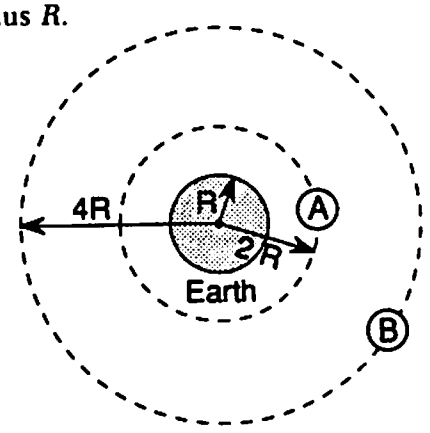
27. What is the magnitude of the centripetal force acting on the cart?
(1) 8.0 N (3) 40. N
(2) 20. N (4) 50. N

28. What would occur as a result of the frictional drag of the atmosphere on an artificial satellite orbiting the Earth?
1 The satellite would increase in speed and escape the gravitational field of the Earth.
2 The satellite would increase in speed and spiral toward the Earth.
3 The satellite would decrease in speed and escape the gravitational field of the Earth.
4 The satellite would decrease in speed and spiral toward the Earth.

29 A cannon with a muzzle velocity of 500. meters per second fires a cannonball at an angle of 30.° above the horizontal. What is the vertical component of the cannonball's velocity as it leaves the cannon?
(1) 0.0 m/s (3) 433 m/s
(2) 250. m/s (4) 500. m/s

Note that question 30 has only three choices.

30 Satellites *A* and *B* are orbiting the Earth in circular orbits as shown below. The mass of satellite *A* is twice as great as the mass of satellite *B*. Earth has radius *R*.

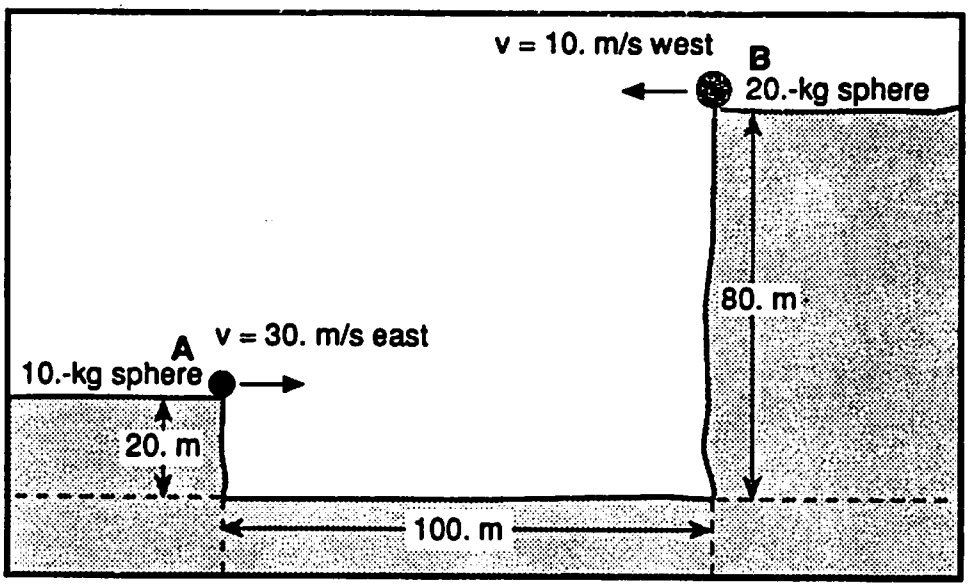


Compared to the orbital period of satellite *A*, the orbital period of satellite *B* is
1 shorter
2 longer
3 the same

M.P. #1

Base your answers to questions 31 through 33 on the information and diagram below.

In the diagram below, a 10.-kilogram sphere, *A*, is projected horizontally with a velocity of 30. meters per second due east from a height of 20. meters above level ground. At the same instant, a 20.-kilogram sphere, *B*, is projected horizontally with a velocity of 10. meters per second due west from a height of 80. meters above level ground. [Neglect air friction.]



31. Initially, the spheres are separated by a horizontal distance of 100. meters. What is the horizontal separation of the spheres at the end of 1.5 seconds?

(1) 15 m
(2) 30. m
(3) 40. m
(4) 45 m

32. The magnitude of the horizontal acceleration of sphere *A* is

(1) 0.0 m/s^2
(2) 2.0 m/s^2
(3) 9.8 m/s^2
(4) 15 m/s^2

33. Compared to the vertical acceleration of sphere *A*, the vertical acceleration of sphere *B* is

1 the same
2 twice as great
3 one-half as great
4 four times as great