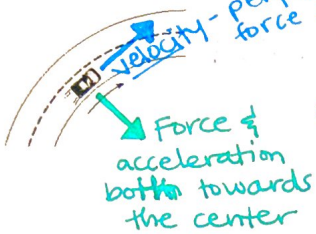
Circular Motion and Law of Universal Gravitation Test Review

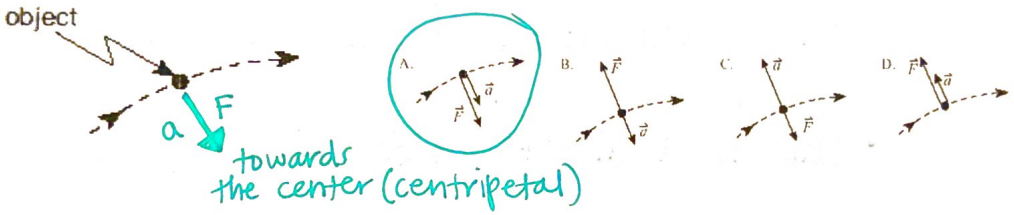
$$a = \frac{v^2}{r} \qquad F = ma \qquad F = G\frac{m_1 m_2}{r^2}$$

1. Uniform circular motion describes the motion of an object in a circle at a constant speed. speed does not change!
2. A car is moving at a constant speed around a circular curve. Which of the following best describes this situation?



	Velocity of Car	Acceleration of Car	Net Force on Car
A.	↗	↗	↖
B.	↗	↘	↖
C.	↗	↘	↘
D.	↘	↘	↘

3. Which vector diagram best represents the acceleration, *a*, and force, *F*, for an object travelling along a circular path?



4. How is an object in circular motion **accelerating** if the object is kept a constant speed?

The object is constantly changing direction

5. A 1300 kg car travels at 25 m/s along a horizontal curve of radius 450 m.
   a) What centripetal acceleration of the car?

$a = 1.39\ m/s^2$

show work for credit!

   b) What is the centripetal force on the car?

$F = 1,807\ N$

show work!

6. Daniela sits on a swing that is attached to an overhanging tree limb by a rope. Daniela's mom pushes her so that her centripetal acceleration is 2.7 m/s². If the length of the rope is 3.2m, what is Daniela's tangential speed?

$a = 2.7\ m/s^2$

$r = 3.2\ m$

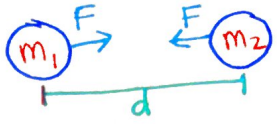
$v = ?$

$a = \frac{v^2}{r}$

$3.2 \times 2.7 = \frac{v^2}{3.2} \times 3.2$

$\sqrt{8.64} = \sqrt{v^2}$ $\quad v = 2.94\ m/s$

7. The gravitational force between two massive spheres



A. depends on how massive they are

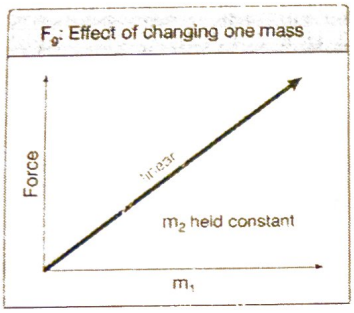
B. is always an attraction.

C. depends inversely on the square of the distances between them.

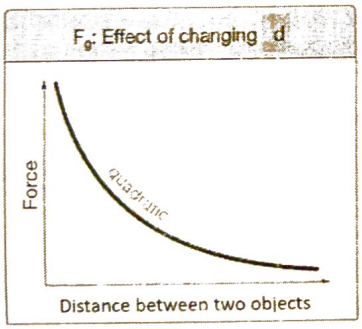
D. all of the above

8. The universal law of gravitation states that all objects are attracted to all other objects with a force.

9. Explain how each of these graphs explain the relationship between mass and the force of gravity, and distance and the force of gravity.



- As the mass of one object increases, the gravitational force between the objects increases.
- This is a direct relationship (↑↑)



- As the distance between two objects increases, the force between them decreases.
- This is an inverse relationship (↑↓)

10. Calculate the gravitational force (F_{grav}) between the Earth (5.98×10^{24}kg) and the Moon (7.35×10^{22} kg) if the distance between them is 3.84×10^{8} m. ($G = 6.67 \times 10^{-11}$)

$F = 2 \times 10^{20}$ N

set up problem to show work!

11. Two asteroids, (m_1 = 1.00 X 10^{12} kg and m_2 = 5.0 X 10^{12} kg), are floating in space. The force of attraction between them is 10.000 N. **How far apart** are their centers of mass?

$F = 10\,N$

$m_1 = 1 \times 10^{12}\ kg$

$m_2 = 5 \times 10^{12}\ kg$

$G = 6.67 \times 10^{-11}$

$d = ?$

$$d^2 \times F = G\frac{m_1 m_2}{d^2} \times d^2$$

$$\frac{Fd^2}{F} = \frac{Gm_1 m_2}{F}$$

$$\sqrt{d^2} = \sqrt{\frac{Gm_1 m_2}{F}}$$

$$d = \sqrt{\frac{Gm_1 m_2}{F}}$$

$$d = \sqrt{\frac{(6.67 \times 10^{-11})(1 \times 10^{12})(5 \times 10^{12})}{10}}$$

$$d = 5.78 \times 10^6\ m$$

12. Two objects gravitationally attract with a force of 21 N. If the distance between the two objects' centers is doubled (×2), then the new force of attraction is 5.25 N.

$$F = G\frac{m_1 m_2}{d^2}$$

$$F = G\frac{m_1 m_2}{2d^2} \rightarrow \frac{1}{2^2} = \frac{1}{4}\times$$

old force = 21 N

new force = $21 \times \frac{1}{4} = 5.25\ N$

13. Two objects gravitationally attract with a force of 83 N. If the distance between the two objects' centers is halved, then the new force of attraction is 332 N.

Show work for credit!