Friday, January 11, 2019

BELL WORK → SAT Science Slots.

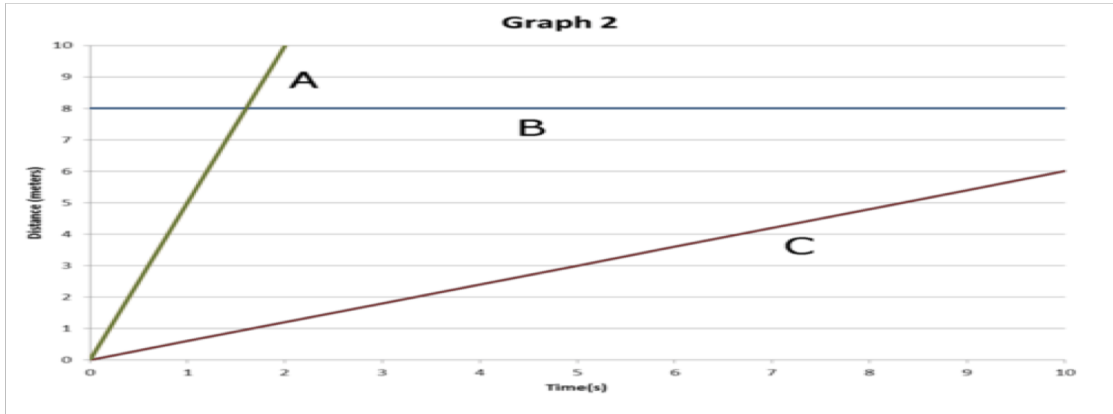
Content Objective WHAT → Students will demonstrate application of the Universal Law of Gravitation- Relationships by completing a structured practice and chapter 13 summary.

Language Objective HOW → Students will write to explain the Universal Law of Gravitation using the big idea, thinking map, summary and formula on a structured practice and chapter 13 summary.

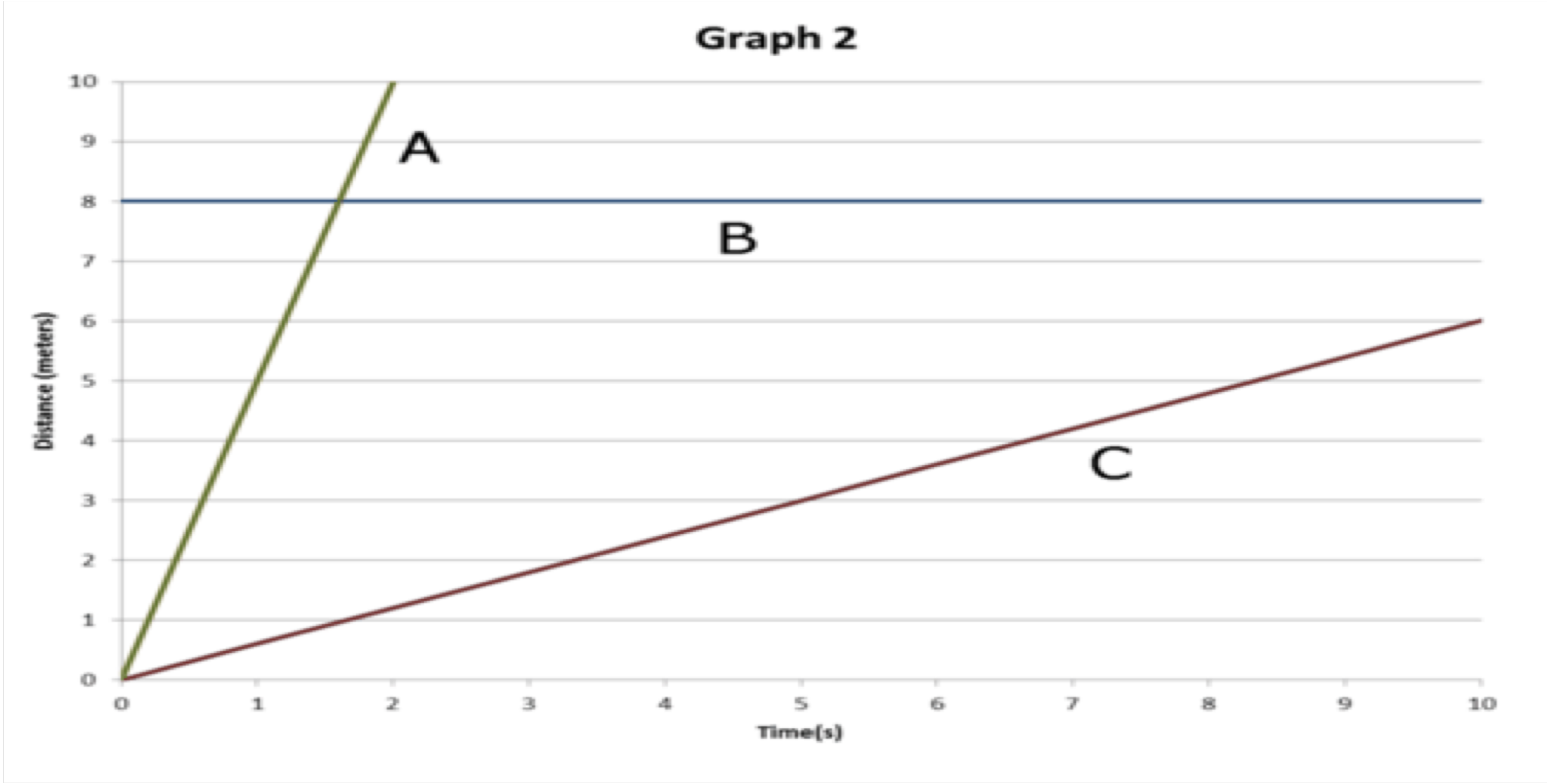
Exit Pass → The Universal Law of Gravitation says that mass is _____ related to force and distance is _____ related to the square of that force.

Position vs. Time Graph (Bell Work-SAT practice)

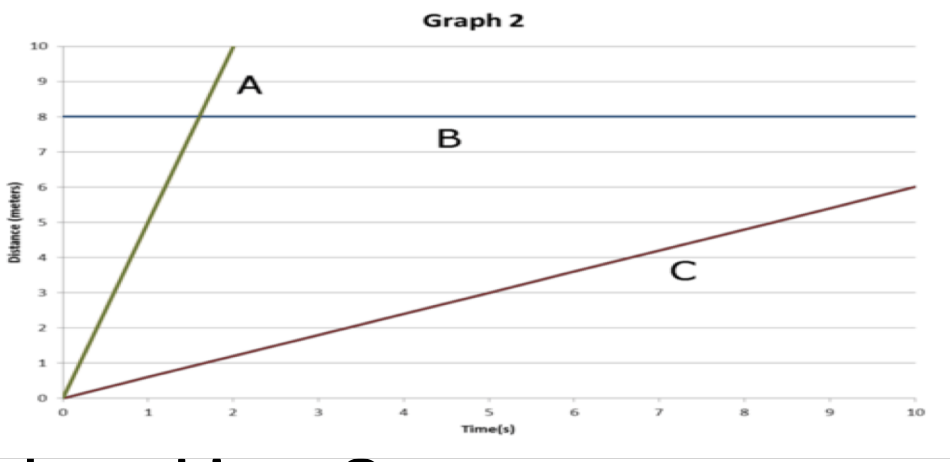
The motion of an object can be represented by a position-time graph like the Figure below. In this type of graph, the y-axis represents position and the x-axis represents time. A position-time graph shows how far an object has traveled from its starting position at any given time since it started moving and the velocity of the moving object is represented by the slope, or steepness, of the graph line.



Position vs. Time Graph (SAT Practice)



Practice Questions (SAT practice)



1. Which line represents a faster speed?
    a. Line A because it is more shallow than Line C
    b. Line A because it is steeper than Line C
    c. Line C because it is steeper than Line B
    d. Line B because it is a horizontal line

2. Which object has the greatest speed?
    a. Object A
    b. Object B
    C. Object C
    d. Not enough information

The Big Idea with a Picture

ULG-Relationship

Universal Law of Gravitation
13.1, 13.4, 13.5
Pg. 232

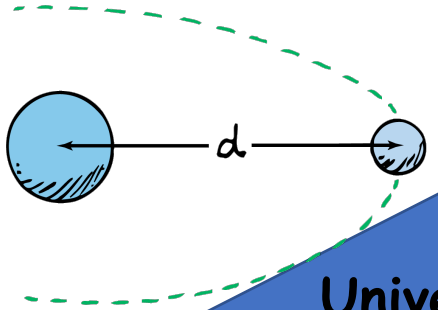
Summary

Formulas and Constants (page 237-239)

Universal Law of Gravitation
13.1, 13.4, 13.5
Pg. 232

The Big Idea with a Picture

.Everything pulls on everything else



ULG Relationship

Every object attracts every other object with a force that is **directly proportional** to the mass of each object.

Force decreases as the square of the distance between the centers of mass of the objects increases, force and distance are **inversely proportional.**

Summary

Newton discovered that gravity is universal. Everything pulls on everything else in a way that involves only mass and distance.

The force of gravity between objects depends on the distance between their centers of mass.

Formulas and Constants (page 237-239)

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

Ch 13 - Universal Law of Gravitation

gravitational force comes from mass

anything with mass has an attracting force of gravity

$$F = \frac{Gm_1m_2}{d^2} \qquad m_1 = \frac{Fd^2}{Gm_2} \qquad d = \sqrt{\frac{Gm_1m_2}{F}}$$

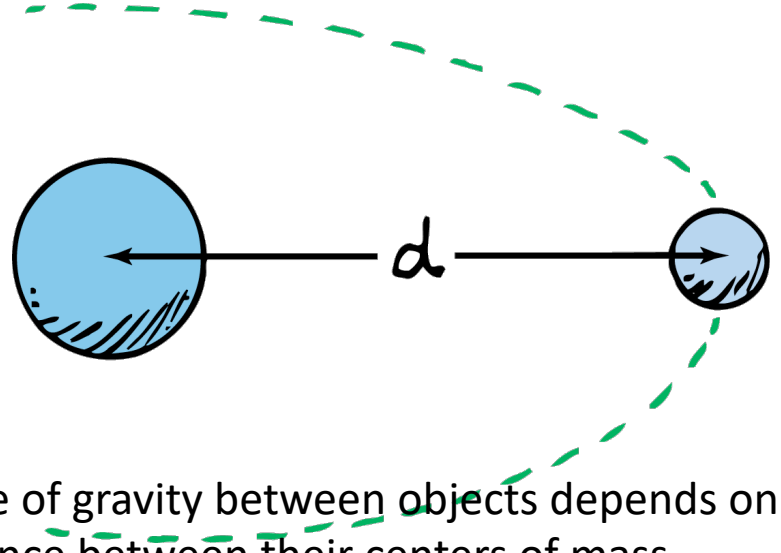
that force is directly proportional to the masses

m x 2 means F x 2 **m / 3 means F / 3**

that force is inversely proportional to the square of the distance

d x 2 means F / 4 **d / 3 means F x 9**

The **universal gravitational constant,** *G,* in the equation for universal gravitation describes the strength of gravity. $G = 6.67 \times 10^{-11}\ \mathrm{N \cdot m^2/kg^2}$



The force of gravity between objects depends on the distance between their centers of mass

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

F = 100 N

what would the force be if...

1) ...m 1 was double?

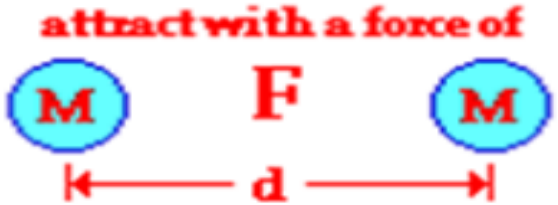
2) ...m 2 was double?

3) ...d was double?

4) ...m 1 and d were both double?

write how the force changes if the other variables change

Effect of Mass on E_{grav}



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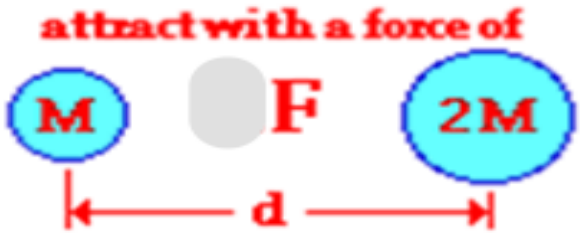

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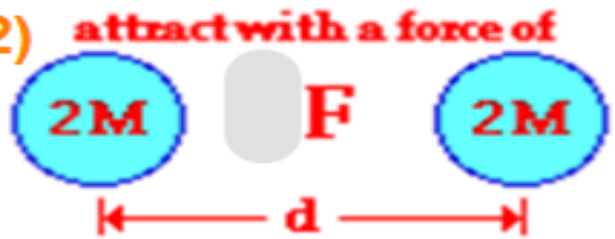

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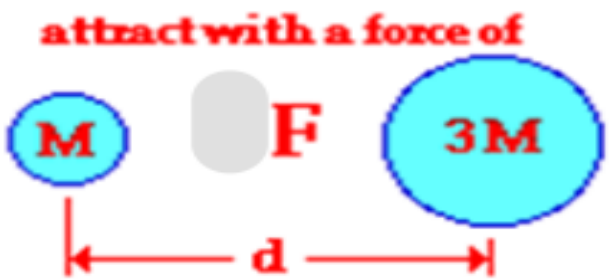
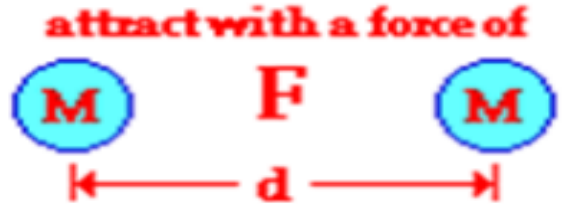


Effect of Distance on E_{grav}



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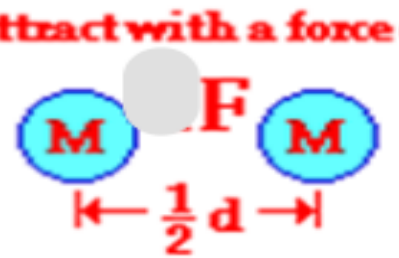

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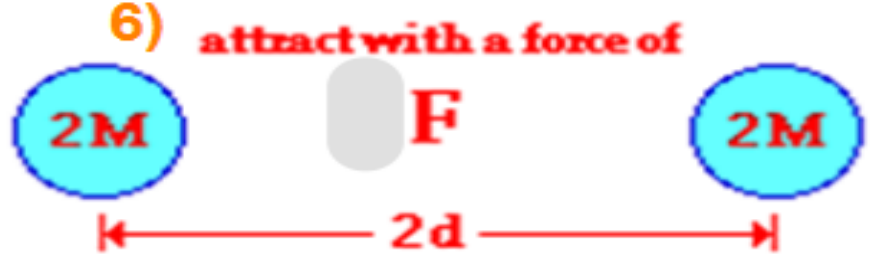
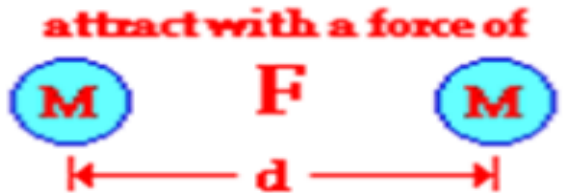
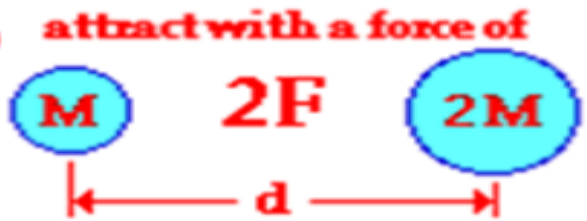


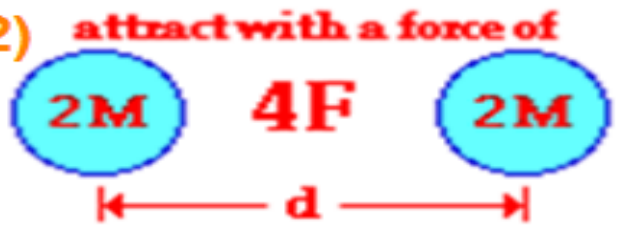
$$F = G\frac{m_1 m_2}{d^2}$$

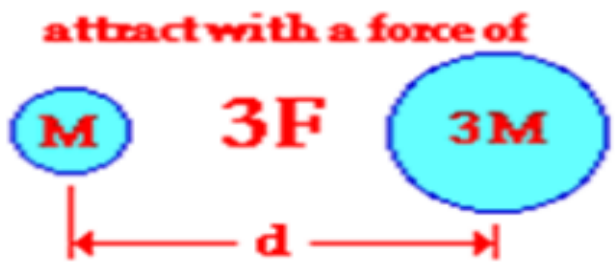
write how the force changes if the other variables change

Effect of Mass on E_{grav}

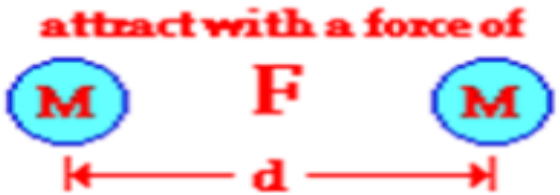


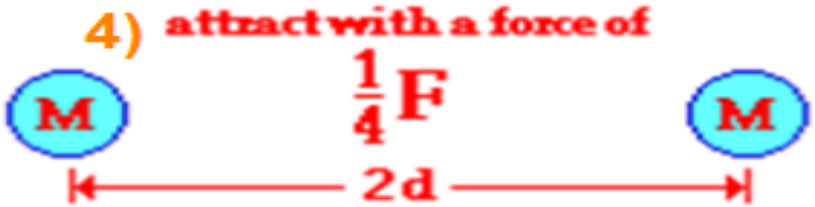
1) 

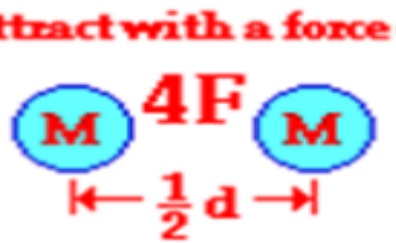
2) 

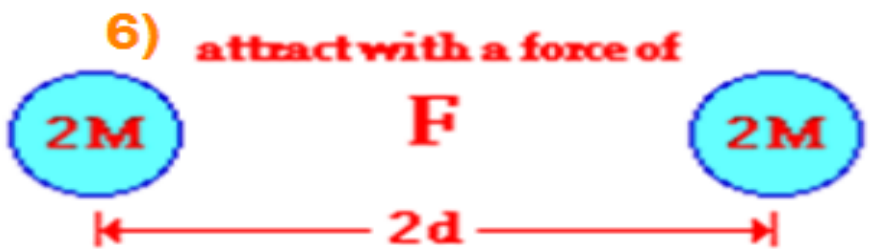
3) 

Effect of Distance on E_{grav}



4) 

5) 

6) 

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

ULG- Relationships

$$F = \frac{Gm_1m_2}{d^2}$$

Class Example	Your Turn
Example 3: Two objects attract each other with a gravitational force of 20 N. If the distance between them doubles, what is the new force of attraction between them?	Example 4: Two objects attract each other with a gravitational force of 90 N. If the distance between them triples, what is the new force of attraction between them?

ULG- Force $F = \frac{Gm_1m_2}{d^2}$

$G = 6.67 \times 10^{-11}\ \mathrm{N \cdot m^2/kg^2}$

Class Example	Your Turn
Example 1: Two students are sitting 2.5 m apart. One student has a mass of 75 kg and the other has a mass of 60 kg. What is the gravitational force between them?	Example 2: Two students are standing 4 m apart. One student has a mass of 65 kg and the other has a mass of 54 kg. What is the gravitational force between them?

ULG- Mass $m_1 = \frac{Fd^2}{Gm_2}$ $G = 6.67 \times 10^{-11}\ N \cdot m^2/kg^2$

Class Example	Your Turn
Example 1: The gravitational force between two objects that are 1.8×10^{-1} m apart is 2.4×10^{-6} N. If the mass of one object is 45 kg, what is the mass of the other object?	Example 2: The gravitational force between two objects that are 2.8×10^{-2} m apart is 3.4×10^{-4} N. If the mass of one object is 45 kg, what is the mass of the other object?

ULG- Distance

$$d = \sqrt{\frac{Gm_1m_2}{F}}$$

$$G = 6.67 \times 10^{-11}\ \mathrm{N \cdot m^2/kg^2}$$

Class Example	Your Turn
Example 1: If two objects each with a mass of $3x10^2$ kg, produce a gravitational force between them of 4.2×10^{-6} N, what is the distance between them?	Example 2: If two objects each with a mass of 450kg, produce a gravitational force between them of 7.8×10^{-6} N, what is the distance between them?