PhyzJob: Proportional Reasoning
THE GRAVITY EDITION

Felix

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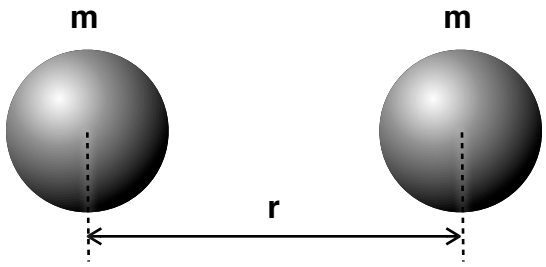
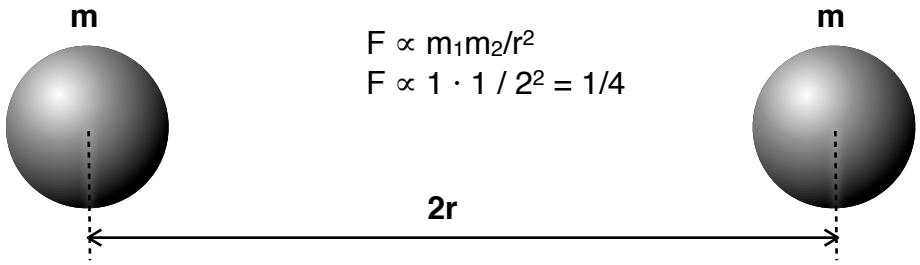


$F \propto m_1 m_2 / r^2$

$F \propto 1 \cdot 1 / 1^2 = 1$

The two spheres shown above attract gravitationally with one unit of force. The mass of each sphere is unknown and the distance between the spheres is unknown. But the gravitational force of attraction is one unit. Use proportional reasoning to determine the force acting on each sphere by drawing the force vectors. Show your ratio reasoning for each case. The first three have been worked out as examples. Study them before trying the remaining problems.

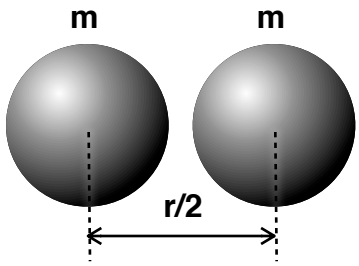
1. **1/4**



$F \propto m_1 m_2 / r^2$

$F \propto 1 \cdot 1 / 2^2 = 1/4$

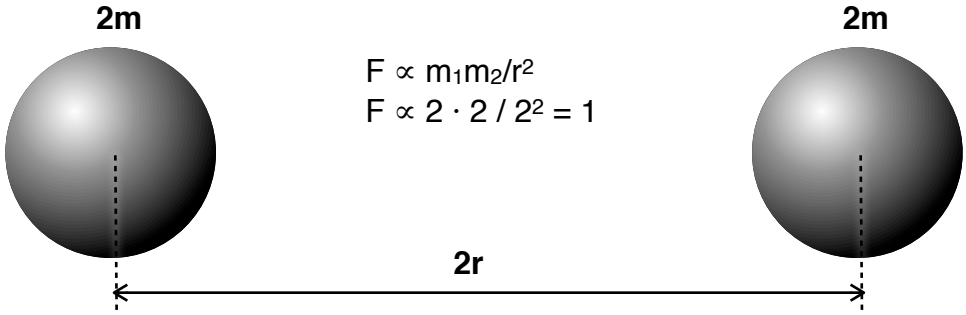
2. **4**



$F \propto m_1 m_2 / r^2$

$F \propto 1 \cdot 1 / (1/2)^2 = 4$

3. **1**



$F \propto m_1 m_2 / r^2$

$F \propto 2 \cdot 2 / 2^2 = 1$

1

4. If the right mass is $m/2$, the left mass is $m/2$, and the distance is $r/2$, what is the gravitational force?
SHOW THE RATIO:

$1/2 \cdot 1/2 \;/\; (1/2)^2 = 1$

1

5. If the right mass is $2m$, the left mass is $m/2$, and the distance is r, what is the gravitational force?
SHOW THE RATIO:

$2 \cdot 1/2 \;/\; 1^2 = 1$

$\frac{1}{9}$

6. If the right mass is m, the left mass is m, and the distance is $3r$, what is the gravitational force?
SHOW THE RATIO:

$1 \cdot 1 \;/\; (3)^2 = 1/9$

$\frac{1}{4}$

7. If the right mass is $m/4$, the left mass is $m/4$, and the distance is $r/2$, what is the gravitational force?
SHOW THE RATIO:

$1/4 \cdot 1/4 \;/\; (1/2)^2 = 1/4$

16

8. If the right mass is $4m$, the left mass is $4m$, and the distance is r, what is the gravitational force?
SHOW THE RATIO:

$4 \cdot 4 \;/\; (1)^2 = 16$

$\frac{2}{5}$

9. If the right mass is $10m$, the left mass is m, and the distance is $5r$, what is the gravitational force?
SHOW THE RATIO:

$10 \cdot 1 \;/\; (5)^2 = 10/25 = 2/5$