Levers: Mechanical Advantage Calculations

Name:____

1. A construction worker uses a board and log as a lever to lift a heavy rock. If the input arm is 3 meters long and the output arm is 0.75 meters long, what is the mechanical advantage of the lever?

2. A 500-Newton box is lifted to a height of 1 meter. Only 50 Newtons of force are needed to lift the box. What is the mechanical advantage of the lever?

3. A lever with an effort distance of 2 meters has a mechanical advantage of 4. What is the resistance distance?

4. A lever with a mechanical advantage of 6 is used to move a 36-Newton load. What input force is needed to move the load with the lever?

5. A child's toy rake is held so that its resistance length is 0.75 meters. If the mechanical advantage is 0.33, what is the effort distance?

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$$IMA = \frac{d_E}{d_R} = \frac{3m}{0.75m} = 4$$

2. A 500-Newton box is lifted to a height of 1 meter. Only 50 Newtons of force are needed to lift the box. What is the mechanical advantage of the lever?

$$AMA = \frac{F_R}{F_E} = \frac{500N}{50N} = 10$$

3. A lever with an effort distance of 2 meters has a mechanical advantage of 4. What is the resistance distance?

$$IMA = \frac{d_E}{d_R} \quad 4 = \frac{2m}{d_R} \quad \mathrm{d_R} = 0.5m$$

4. A lever with a mechanical advantage of 6 is used to move a 36-Newton load. What input force is needed to move the load with the lever?

$$AMA = \frac{F_R}{F_E} \quad 6 = \frac{36N}{F_E} \quad \mathrm{F_E} = 6N$$

5. A child's toy rake is held so that its resistance length is 0.75 meters. If the mechanical advantage is 0.33, what is the effort distance?

$$IMA = \frac{d_E}{d_R} \quad 0.33 = \frac{d_E}{0.75m} \quad \mathrm{d_E} = 0.25m$$