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EXAM A

- 1) What is the force required to stretch a spring whose constant value is 175 N/m by an amount of 30 cm? 3 points

SOLUTION:

$$x = 30 \text{ cm} \cdot \frac{1 \text{ m}}{100 \text{ cm}} = 0,3 \text{ m}$$

$$F = k \cdot x \text{ (Hooke's Law)}$$

$$F = 175 \text{ N/m} \cdot 0,3 \text{ m} = 52,5 \text{ N}$$

- 2) What is the spring constant of a spring if a force of 196 N is applied and causes a compression of 2,3 m? 4 points

SOLUTION:

$$F = k \cdot x \text{ (Hooke's Law)} \Rightarrow k = \frac{F}{x}$$

$$k = \frac{196 \text{ N}}{2,3 \text{ m}} = 85,2 \text{ N/m}$$

- 3) What will be the extension of a spring whose constant is 35 N/m if the load hanging from it weighs 63 N? 3 points

SOLUTION:

$$F = k \cdot x \text{ (Hooke's Law)} \Rightarrow x = \frac{F}{k}$$

$$x = \frac{63 \text{ N}}{35 \text{ N/m}} = 1,8 \text{ m}$$

FORCES EXAM

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4) The Space Shuttle has a liftoff mass of 2041000 kg and accelerates at a rate of 16 m/s^2 . Calculate the force (thrust) that is accelerating the Space Shuttle. 3 points

SOLUTION:

$$F = m \cdot a \text{ (Newton's 2nd Law of Motion)}$$

$$F = 2\,041\,000 \text{ kg} \cdot 16 \text{ m/s}^2 = 32\,656\,000 \text{ N}$$

5) A runner has a mass of 89 kilograms. He produces a force of 84 Newtons between the ground and his running shoes. How fast does he accelerate? 3,5 points

SOLUTION:

$$F = m \cdot a \text{ (Newton's 2nd Law of Motion)} \Rightarrow a = \frac{F}{m}$$

$$a = \frac{84 \text{ N}}{89 \text{ kg}} = 0,94 \text{ m/s}^2$$

6) A rocket accelerates at 56 m/s^2 with the force (thrust) of 44800 N. What is the mass of the rocket? 3,5 points

$$F = m \cdot a \text{ (Newton's 2nd Law of Motion)} \Rightarrow m = \frac{F}{a}$$

$$m = \frac{44\,800 \text{ N}}{56 \text{ m/s}^2} = 800 \text{ kg}$$

7) How much would a 100 kg man weigh on the Earth if the acceleration due to gravity is $9,81 \text{ m/s}^2$? 5 points

SOLUTION:

$$W = m \cdot g$$

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$$W = 100 \text{ kg} \cdot 9,81 \text{ m/s}^2 = 981 \text{ N}$$

8) A space ship has a mass of 9 000 kg. The space ship is launched from Earth and lands on a distant planet where it has a weight of 390 000 N. What is the acceleration of gravity on this planet?

5 points

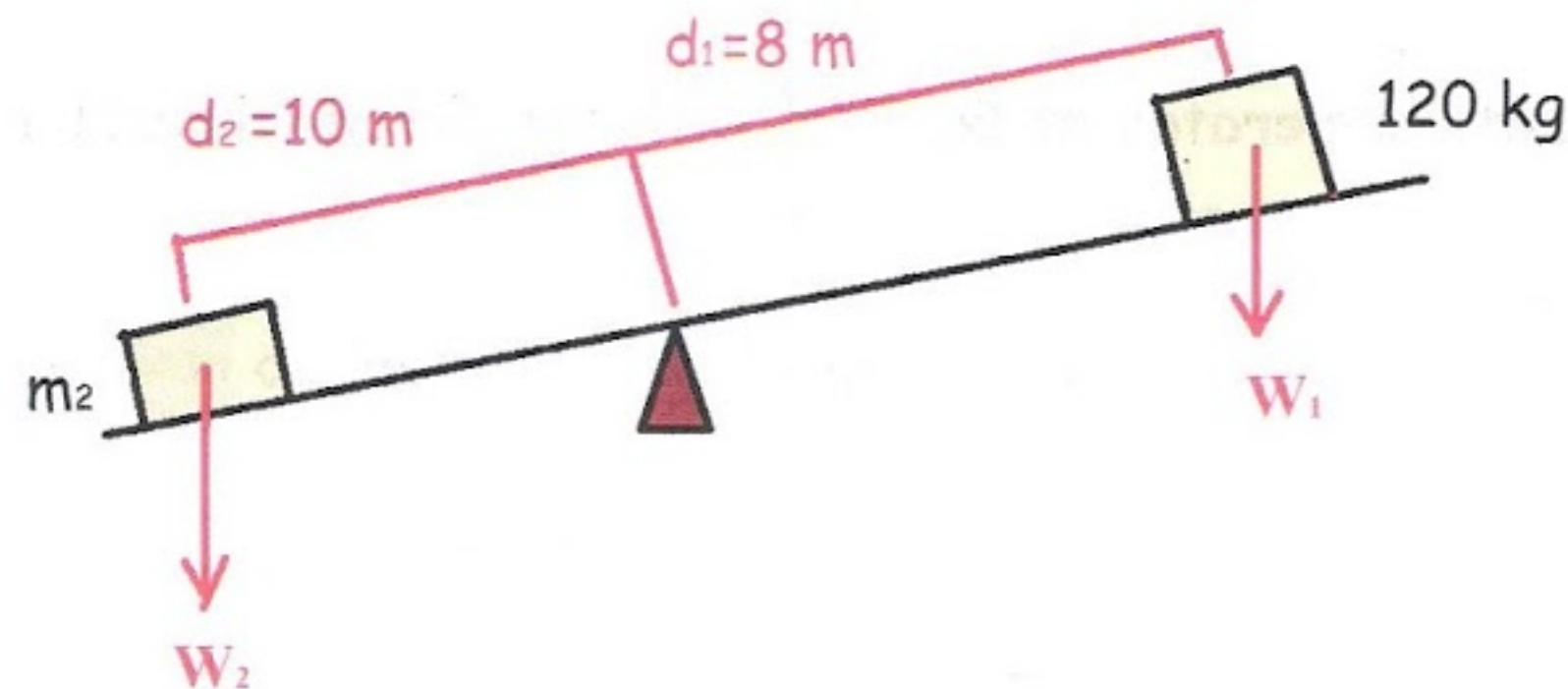
SOLUTION:

$$W = m \cdot g \Rightarrow g = \frac{W}{m}$$

$$g = \frac{390\,000 \text{ N}}{9\,000 \text{ kg}} = 43,3 \text{ m/s}^2$$

9) A 120 kg mass is located 8 m from the fulcrum of a lever. How much mass at a distance of 10 m on the opposite side of the fulcrum would balance it?

10 points

SOLUTION:

$$F_1 \cdot d_1 = F_2 \cdot d_2$$

$$120 \text{ kg} \cdot 9,81 \text{ m/s}^2 \cdot 8 \text{ m} = m_2 \cdot 9,81 \text{ m/s}^2 \cdot 10 \text{ m}$$

$$120 \cdot 8 = m_2 \cdot 10$$

$$m_2 = \frac{120 \cdot 8}{10} = 96 \text{ kg}$$