Solving for planet mass.

$$M = \frac{ar^2}{G}$$

Note:
r must be greater than the radius of the planet

G is the universal gravitational constant
$G = 6.6726 \times 10^{-11} \text{N-m}^2/\text{kg}^2$

Newton's law of gravity

$F = \frac{Gm_1m_2}{r^2}$	gravitational force exerted between two objects
$m_1 = \frac{Fr^2}{Gm_2}$	mass of object 1
$m_2 = \frac{Fr^2}{Gm_1}$	mass of object 2
$r = \sqrt{\frac{Gm_1m_2}{F}}$	distance between the objects

Kepler's third law

$T = \sqrt{\frac{4\pi^2r^3}{GM}}$	satellite orbit period
$r = \sqrt[3]{\frac{T^2GM}{4\pi^2}}$	satellite mean orbital radius
$M = \frac{4\pi^2r^3}{GT^2}$	planet mass

gravitational acceleration

$a = \frac{GM}{r^2}$	gravitational acceleration – r = radius in m, mass in Kg
$M = \frac{ar^2}{G}$	planet mass

$r = \sqrt{\frac{GM}{a}}$	radius from the planet center

escape or critical speed

$v_e = \sqrt{\frac{2GM}{R}}$	escape or critical speed
$M = \frac{v_e^2 R}{2G}$	planet mass
$R = \frac{2GM}{v_e^2}$	planet radius