

(1) Solve the initial value problem, and compute $y(\infty)$

$$y' = 4y - y^3, \quad y(0) = 1.$$

(2) Find the most general solution to

$$y' = \frac{3}{x}y + x^2.$$

(3) Use the Euler method with step size $h = 0.5$ to obtain an approximation to $y(1)$ for the problem

$$y' = x^2 + y^2, \quad y(0) = 1.$$

(4) (word problem) On a distant planet the gravity constant is $g = 4 \text{ m/s}^2$. Alien A stands 4 m above ground and throws a rock upward with an initial velocity of 2 m/s . Alien B stands 6 m above ground and throws a rock with an initial velocity of $v \text{ m/s}$.

(a) If both rocks hit the ground at the same time, what is v ?

(b) Whose rock achieves the greatest maximum height?

Note: if $h_A(t)$ (resp. $h_B(t)$) denotes the height of alien A's (resp. B's) rock, then $h_A''(t) = h_B''(t) = -g$.

(5) Solve the following ODEs

(a) $y'' + 2y' + y = 0$

(b) $y'' + y = e^x + \cos(x) + x$

(c) $y'' + y' = 1$.