

Cal I SI Worksheet

1. Find the most general form of the function $f(x)$

$$f'(x) = 5x^2 - 8x + 3$$

$$f(x) = \frac{5}{3}x^3 - 4x^2 + 3x + C$$

$$f'(x) = \cos(3x) + 2$$

$$f(x) = \frac{1}{3}\sin(3x) + 2x + C$$

$$f'(x) = 2x^{\frac{4}{5}} - 7x^{\frac{2}{5}} + x^{\frac{1}{5}}$$

$$f(x) = 2\left(\frac{5}{9}\right)x^{\frac{9}{5}} - 7\left(\frac{5}{7}\right)x^{\frac{7}{5}} + \frac{5}{6}x^{\frac{6}{5}} + C$$

$$f(x) = \frac{10}{9}x^{\frac{9}{5}} - 5x^{\frac{7}{5}} + \frac{5}{6}x^{\frac{6}{5}} + C$$

$$f'(x) = 5 - (1+x^2)^{-1}$$

$$f(x) = 5x - \tan^{-1}(x) + C$$

2. Find $f(x)$ with the given conditions:

$$f'(x) = x^3 - 2x + 1 \quad f(2) = 3$$

$$f(x) = \frac{1}{4}x^4 - x^2 + x + C$$

$$f(x) = \frac{1}{4}x^4 - x^2 + x + 1$$

$$3 = \frac{1}{4}(2)^4 - (2)^2 + 2 + C = \frac{1}{4}(16) - 4 + 2 + C$$

$$3 = 2 + C \Rightarrow C = 1$$

$$f'(x) = e^x + 5 - \sin(x) \quad f(0) = 10$$

$$f(x) = e^x + 5x + \cos x + C$$

$$f(x) = e^x + 5x + \cos x + 8$$

$$10 = e^0 + 5(0) + \cos(0) + C = 2 + C$$

$$C = 8$$

$$f''(x) = 5 - 2x \quad f(0) = 3 \quad f(2) = 4$$

$$f'(x) = 5x - x^2 + C_1$$

$$f(x) = \frac{5}{2}x^2 - \frac{1}{3}x^3 + C_1x + C_2$$

$$f(x) = \frac{5}{2}x^2 - \frac{1}{3}x^3 - \frac{19}{6}x + 3$$

$$3 = \frac{5}{2}(0) - \frac{1}{3}(0) + C_1(0) + C_2$$

$$\Rightarrow C_2 = 3$$

$$4 = \frac{5}{2}(2)^2 - \frac{1}{3}(2)^3 + C_1(2) + 3$$

$$\Rightarrow C_1 = -\frac{19}{6}$$

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3. A math Cal 1 student throws their textbook from the top of the math building 42 feet above the ground with an initial velocity of 5 ft/s. Acceleration due to gravity is $a = -32.2 \text{ ft/s}^2$.

a. Find formulas for $v(t)$ and $s(t)$, the velocity of the textbook and height of the textbook after t seconds.

$$\begin{aligned}a(t) &= -32.2 \text{ [ft/s}^2\text{]} \\v(t) &= -32.2t + v_0 \\s(t) &= -16.1t^2 + v_0(t) + s_0\end{aligned}$$

$$\begin{aligned}v(0) &= 5 \\5 &= -32.2(0) + v_0 \\5 &= v_0\end{aligned}$$

$$\begin{aligned}v(t) &= -32.2t + 5 \text{ [m/s]} \\s(t) &= -16.1t^2 + 5t + 42 \text{ [m]}\end{aligned}$$

$$\begin{aligned}s(0) &= 42 \\42 &= -16.1(0) + v_0(0) + s_0 \\42 &= s_0\end{aligned}$$

b. How long does it take the textbook to hit the ground?

$$\begin{aligned}0 &= -16.1t^2 + 5t + 42 \\-5 \pm \sqrt{5^2 - 4(-16.1)(42)} \\&\quad 2(-16.1)\end{aligned}$$

$$t = 1.7785s, -1.467s$$

c. What is the highest point that the textbook reaches?

highest point $\Rightarrow v(t) = 0$

$$\begin{aligned}0 &= -32.2t + 5 \\0.155s &= t\end{aligned}$$

$$s(0.155) = -16.1(0.155)^2 + 5(0.155) + 42$$

$$s(0.155) = 42.39 \text{ ft}$$

d. What is the velocity of the textbook when it strikes the ground?

$$v(1.778) = -32.2(1.778) + 5$$

$$v(1.778) = -52.25 \text{ m/s}$$