warm-up

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(x^2+3x+1\right)$$

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(3x^{e+4}\right)$$

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{1}{x^2}\right)$$

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(e^x\right)$$

round 1

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(\sqrt{5}x + \frac{\sqrt{7}}{x}\right)$$

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(e^x - x^e\right)$$

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{5}{x^3}\right)$$

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(\sqrt[4]{x} - 4e^x\right)$$

round 2

$$\frac{\mathrm{d}}{\mathrm{d}x}(x+1)^2$$

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{x^6}{5}\right)$$

$$\frac{\mathrm{d}}{\mathrm{d}x}(6x^3-x)(10-20x)$$

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{1}{x}\right)$$

round 3

An Airbus A380-800 long-range jetliner is flying a route from Reagan National Airport in DC to Narita International Airport in Tokyo. The aircraft's altitude (in thousands of feet relative to sea level) during the flight is described by the function

$$H(t) = \begin{cases} -32t^2 + 64t & 0 \le t \le 1 \\ 32 & 1 < t < 10 \\ -16(t-10)^2 + 32 & 10 \le t < 11 \\ 16(12-t)^2 & 11 \le t \le 12 \end{cases}$$

where t is time since takeoff (in hours).

1. Verify that this function is continuous and that the plane's altitude is 0 before takeoff and after landing.
2. Does the aircraft abruptly stop climbing, or does it "level off" when it reaches cruising altitude? How do you know?
3. At what rate is the plane climbing when $t = 1/3$? When $t = 3$? When $t = 11$?
4. How quickly is the aircraft descending five minutes before landing? One minute? How would you describe its behavior in words?