■ 1. The population of box turtles in a wooded area is given by $R(t) = 3{,}000 - 1{,}200e^{-0.12t}$, where t is measured in years. What would the meaning of $R'(4) = 89.104$ be in the context of the problem?

A There are an average of 89.104 turtles in the wooded area over the first 4 years.

B When $t = 4$ years, the number of turtles in the wooded area is increasing by 89.104 turtles per year.

C In year 4, approximately 89 more turtles will come into the wooded area.

D There will be a total of approximately 89 turtles in the forest after 4 years.

■ 2. Given the function $h(x) = 2xe^{x-4}$, find an equation for the tangent line to the curve when $x = 5$.

A $y - 5 = 12e(x - 10e)$

B $y - 10e = 2e(x - 5)$

C $y - 5 = 2e(x - 10e)$

D $y - 10e = 12e(x - 5)$

■ 3. A particle moves along a curve and its position is represented by $s(t) = t^3 + \cos(\pi t)$. Find the acceleration of the particle after 2 seconds.

A -13 units/sec^2

B $-12 + \pi^2$ units/sec^2

C $12 - \pi^2$ units/sec^2

D 11 units/sec^2

■ 4. Given that the velocity of a particle can be modeled by $v(t) = t^2 - 8t + 15$ for $t \geq 0$, on what time interval(s) is the particle speeding up?

A $(4,\infty)$

B $(0,4)$

C $(0,3) \cup (4,5)$

D $(3,4) \cup (5,\infty)$

■ 5. Given $g(x)$ is a twice differentiable function and that the tangent line to $g(x)$ at $x = 3$ was used to approximate the value of $g(2.9)$, which piece of information would guarantee that $g(2.9)$ is an overestimate of the true value?

A $g(x)$ is concave down on the interval $(2.9,3)$

B $g(x)$ is concave up on the interval $(2.9,3)$

C $g(x)$ is increasing on the interval $(2.9,3)$

D $g(x)$ is decreasing on the interval $(2.9,3)$

■ 6. If $y = 3x^2 - 2x$ and $u = 4x - 1$, find $\frac{dy}{du}$.

A $\frac{3x-1}{2}$

B $\frac{12x^2 - 6x + 1}{(4x-1)^2}$

C $24x + 1$

D $6x - 2$

■ 7. Air is being sucked out of a spherical balloon so that its volume is decreasing by 250 cm^3/s. How fast is the radius decreasing when the radius is 5 cm?

A $\frac{5}{2\pi}$ cm/s

B $-\frac{5}{2\pi}$ cm/s

C $\frac{2}{5\pi}$ cm/s

D $-\frac{2}{5\pi}$ cm/s

■ 8. A point moves along the curve $y = 2x^2 - 1$ in such a way that y is decreasing at a rate of 2 units per second. At what rate is x changing when $x = \frac{3}{2}$?

A Decreasing at $\frac{7}{2}$ units/s

B Increasing at $\frac{7}{2}$ units/s

C Decreasing at $\frac{1}{3}$ units/s

D Increasing at $\frac{1}{3}$ units/s

■ 9. An item is currently selling for $\$150$/unit. The quantity supplied is decreasing by 25 units/week. At what rate is the price of the item changing, if $q = 4{,}000e^{-0.01p}$?

A $\$1.03$ per week

B $\$2.80$ per week

C $\$2.64$ per week

D $\$0.97$ per week

■ 10. Evaluate the limit $\lim_{x \to \infty} \frac{2x - e^x}{4x + \ln x}$.

A ∞

B $\frac{1}{2}$

C $-\infty$

D 0

■ 11. Sand falling from a chute forms a conical pile whose height is always equal to $\frac{4}{3}$ of the radius of the base. How fast is the volume changing when the radius of the base is 6 inches and increasing at a rate of $\frac{1}{2}$ inches per minute? The volume of a cone is given by $V = \frac{1}{3}\pi r^2 h$.

■ 12. The position of a particle moving along the x-axis is represented by $x(t) = \sqrt[3]{t^3 + 2t}$, where $x(t)$ represents the position at t seconds on the interval $0 \leq t \leq 10$.

a. Determine the average velocity of the particle on $[0,2]$ (from 0 seconds to 2 seconds).

b. Determine the velocity function.

c. Determine the acceleration of the particle when $t = 2$ seconds.

■ 13. Water is entering a tank at the rate $E(t) = 9 - 2^{0.3t}$ gallons/minute and leaving at a rate of $L(t) = 1 + x\tan^{-1}x$ gallons/minute.

a. Find $E'(2)$. Explain the meaning of $E'(2)$ in the context of the problem.

b. Is the level of water in the tank increasing or decreasing at $t = 5$? Justify your answer.

c. Assuming there were 18 gallons of water in the tank at $t = 5$, use a linear approximation to estimate the amount of water in the tank at $t = 5.25$ minutes.