1) A business has determined that the total profit in hundreds of dollars from selling x items is given by the profit function, $P(x) = 4x^2 - 6x + 2$. Find the average rate of change of profit as x changes from 3 to 5. Which statement describes the interpretation of this result?

A. As 3 to 5 items are sold, the average profit is increasing by about \$2600 per item.
B. As 3 to 5 items are sold, the average profit is increasing by about \$1800 per item.
C. As 3 to 5 items are sold, the average profit is increasing by about \$3400 per item.
D. As 3 to 5 items are sold, the average profit is increasing by about \$3000 per item.
E. As 3 to 5 items are sold, the average profit is increasing by about \$2500 per item.

2) For a function *f*, the definition of the derivative is $\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$. Given the function $f(x) = -x^2 + 2x - 7$, use the limit definition of the derivative to find the derivative. Which **choice is one** of the intermediate or final steps in this process?

A. $f'(x) = -2x - 7$

B. $f'(x) = \lim_{h\to 0}\left(\frac{-x^2 - 2xh - h^2 + 2x + 2h - 7 - (-x^2 + 2x - 7)}{h}\right)$

C. $f'(x) = \lim_{h\to 0}\left(\frac{-x^2 - h^2 + 2x + 2h - 7 + x^2 - 2x + 7}{h}\right)$

D. $f'(x) = \lim_{h\to 0}\left(\frac{-2x - h + 2}{h}\right)$

E. $f'(x) = \lim_{h\to 0}(-2x - 2h + 2)$

3) Find the equation of the tangent line to the curve of $f(x)=\frac{1}{2x}+2\sqrt{x}$ at the point $\left(1,\frac{5}{2}\right)$. Write your equation in slope-intercept form.

A. $y=-4x-\frac{3}{2}$

B. $y=\frac{1}{2}x-\frac{5}{2}$

C. $y=\frac{3}{2}x-4$

D. $y=\frac{1}{2}x+\frac{3}{2}$

E. None of the above.

4) The demand function (price function) for the production of *x* hamburgers is $p=\frac{60,000-x}{20,000}$.
The cost function (in dollars) of producing *x* hamburgers is given by $C(x)=5000+0.56x$ where $0\le x\le 50000$. Find the marginal **profit (or loss)** when 20,000 hamburgers are produced.
Hint: You will need to write a revenue function first.

A. \$0.44 per hamburger

B. −\$0.44 per hamburger

C. −\$1.44 per hamburger

D. \$0.56 per hamburger

E. −\$0.56 per hamburger

5) Find all point(s) where the tangent line to the graph of $y=(2x-1)(x^2+2x+1)$ is horizontal.
Hint: Think about the slope of a horizontal line.

A. $\left(\frac{1}{2},0\right)$, $(-1,0)$

B. $(0,-1)$, $(-1,0)$

C. $\left(\frac{1}{2},0\right)$

D. $(-1,0)$

E. $(0,-1)$

6) Find the slope of the tangent line to the graph of $f(x) = x^3 + 9x^2 + 19x - 10$ when $x = -4$. Which statement describes this slope?

A. The slope is less than -10.
B. The slope is between -10 and -6.
C. The slope is between -6 and -2.
D. The slope is between -2 and 2.
E. The slope is greater than 2.

7) If $g(x) = \dfrac{x^3 - 5x^2 - 7x + 3}{2\sqrt{x}}$, find $g'(x)$.

A. $g'(x) = 3x^{5/2} - 10x^{3/2} - 7x^{1/2}$
B. $g'(x) = \frac{5}{4}x^{3/2} - \frac{15}{4}x^{1/2} - \frac{7}{4}x^{-1/2} - \frac{3}{4}x^{-3/2}$
C. $g'(x) = \frac{7}{4}x^{5/2} - \frac{25}{4}x^{3/2} - \frac{21}{4}x^{1/2} + \frac{3}{4}x^{-1/2}$
D. $g'(x) = -\frac{1}{2}x^{5/2} + 4x^{3/2} - \frac{3}{2}x^{1/2} - 2x^{-1/2}$
E. None of the above.

8) Given the following information about some values of two functions *f* and *g*:

$g(3) = 4,\ g'(3) = 5,\ f(3) = 9,\ f'(3) = 8$

If $h(x) = \dfrac{f(x)}{g(x)}$, find $h'(3)$.

A. $\frac{13}{16}$
B. $\frac{77}{16}$
C. $\frac{8}{5}$
D. $-\frac{13}{16}$
E. $-\frac{13}{4}$

9) Solve the equation $f'(x)=0,$ where $f(x)=(x^2-2)(x^2-1).$

A. $x=-\sqrt{\frac{2}{3}},\ 0,\ \sqrt{\frac{2}{3}}$

B. $x=-\sqrt{2},\ -1,\ 2,\ \sqrt{2}$

C. $x=-\sqrt{\frac{3}{2}},\ \sqrt{\frac{3}{2}}$

D. $x=-\sqrt{\frac{3}{2}},\ 0,\ \sqrt{\frac{3}{2}}$

E. $x=1,\ \sqrt{2}$

10) Find $\frac{dy}{dx}$ if $y=(2x^2-5x+1)^3.$

A. $\frac{dy}{dx}=(12x-5)(2x^2-5x+1)^2$

B. $\frac{dy}{dx}=3(4x-5)(2x^2-5x+1)^2$

C. $\frac{dy}{dx}=3(4x-5)^2$

D. $\frac{dy}{dx}=12x(2x^2-5x+1)^2$

E. $\frac{dy}{dx}=12(4x-5)^2$

11) Find the slope of the tangent line to $f(x)=\frac{\frac{1}{2}x+1}{2x-3}$ at the point $\left(4,\frac{3}{5}\right).$

A. $m=\frac{17}{50}$

B. $m=\frac{1}{25}$

C. $m=\frac{-7}{25}$

D. $m=\frac{1}{50}$

E. $m=\frac{-7}{50}$

12) Experiments show that when a flea jumps, its height (in meters) after *t* seconds is given by $H(t) = \frac{1}{10}(44t - 49t^2)$. Find the instantaneous **velocity** of the flea after 0.2 seconds. Remember: Velocity is instantaneous rate of change in height distance with respect to time.

A. 4.88 m/sec
B. 1.22 m/sec
C. 2.44 m/sec
D. 12.2 m/sec
E. 24.4 m/sec

13) Solve the equation below and select the correct description of the solution.

$$16^{x+3} = 64^{2x-1}$$

A. The solution is less than -1.
B. The solution is between -1 and 0.
C. The soltuion is between 0 and 1.
D. The solution is between 1 and 2.
E. The solution is greater than 2.

14) Julie invested $28,000 she won in a lottery. She was able to get a 4% annual interest rate compounded semiannually. How much **interest** has Julie earned in the account in 4 years? Round your interest amount to the nearest dollar. See formulas on the cover sheet.

A. $4806
B. $4850
C. $4756
D. $4858
E. $4832

15) Find the derivative of function *h*. Write answer in factored form.

$$h(x) = 4x(6x^5 + 5)^3$$

A. $4(6x^5 + 5)^2(6x^5 + 3x + 5)$

B. $360x^4(6x^5 + 5)^2$

C. $4(6x^5 + 5)^2(90x^5 + 11)$

D. $4(6x^5 + 5)^2(6x^5 + 90x^2 + 5)$

E. $4(6x^5 + 5)^2(96x^5 + 5)$