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I. Circle the right answer. (5 point each)

1) Find the slope for $f(x) = -5x^2$ at $x=3$

- A) 30 B) -75 C) -45 D) -30

$f(x) = -10x$
 $f(3) = -10(3)$
 $m = -30$

2) What is the equation of the tangent line for the curve $y = x^3 + 2$ at the point $(-1, 1)$

- A) $y = -3x + 4$ B) $y = 3x - 4$ C) $y = 3x + 4$ D) $y = -3x - 4$

3) The following functions is not differentiable at $x = -4$

not continuous

- a) $f(x) = |x+4|$ b) $f(x) = x^2 - 4$ c) $f(x) = \frac{x+2}{x-4}$ $f(x) = \sqrt{-x+4}$
 $x = -4$

4) The following function is not differentiable at $x = 1$

- a) $f(x) = \frac{1}{x+1}$ b) $y = (x-1)^3$ c) $f(x) = |x+1|$ d) $f(x) = \sqrt[3]{x-1}$
 $x = 1$

II. Answer the following questions.

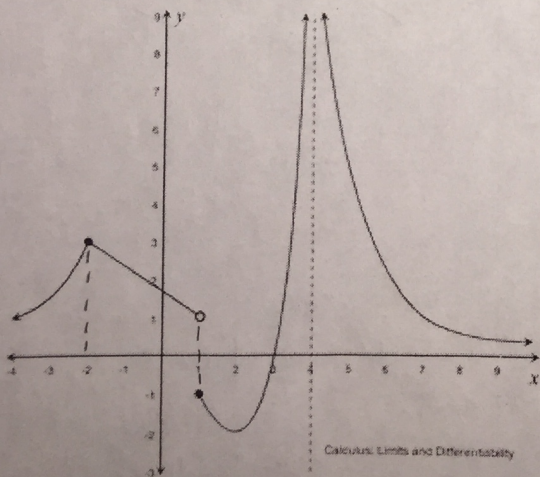
1. The position of an object, s , at any time, t , is given by: (15 points)

$s(t) = -18t^3 + 15t + 8$ where s is measured in feet and t is measured in seconds.

Find the equation of acceleration at any time $a(t)$.

$s(t) = -18t^3 + 15t + 8$ $a(t) = -108t$
 $v(t) = -54t^2 + 15$

2. The following graph shows the function $y = f(x)$ (20 points)



- a) Find the values of "x" where the function is not continuous $x = -2$ and $x = 4$
b) Find the values of "x" where the function is not differentiable $x = -2$, $x = 1$ and $x = 4$

$f(x) = 3x^2$ $y - y_1 = m(x - x_1)$
 $f(-1) = 3(-1)^2$ $y - 1 = 3(x + 1)$
 $m = 3$ $y - 1 = 3x + 13$
 $f(-1) = (-1)^3 + 2$ $y = 3x + 4$
 $y = 1$

$f(x) = -5x^2$
 $f'(x) = -10x$
 $f'(3) = -10(3)$
 $m = -30$

$f(x) = x^3 + 2$ $f(-1) = (-1)^3 + 2$
 $f'(x) = 3x^2$ $f'(-1) = 1$
 $f'(-1) = 3(-1)^2$ $y = 1$
 $m = 3$
 $y - y_1 = m(x - x_1)$
 $y - 1 = 3(x + 1)$
 $y - 1 = 3x + 13$
 $y = 3x + 13 + 1$
 $y = 3x + 14$

$$\begin{aligned} &(x+h)(x+h) \\ &x^2 + xh + xh + h^2 \\ &x^2 + 2xh + h^2 \end{aligned}$$

III. Find the derivative by definition of the following function: (15 points)

$$f(x) = 3x^2 + 5 \quad \text{bx}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{3(x+h)^2 + 5 - (3x^2 + 5)}{h} \quad f'(x) = \lim_{h \rightarrow 0} \frac{3(x^2 + 2xh + h^2) + 5 - (3x^2 + 5)}{h}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 + 5 - 3x^2 - 5}{h} \quad f'(x) = \lim_{h \rightarrow 0} \frac{6xh + 3h^2}{h}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h} \quad f'(x) = \lim_{h \rightarrow 0} 6x + 3(0) \quad \boxed{f'(x) = 6x}$$

IV. Find the derivative of the following:

a) $f(x) = 8\sqrt{x^3} - 2x^3 + \frac{5}{x^2}$ (10 points)

$$f'(x) = 8x^{\frac{3}{2}-1} - 2 \cdot 3x^{3-1} + 5x^{-2-1}$$

$$f'(x) = 6x^{\frac{1}{2}} - 6x^2 - 10x^{-3}$$

$$\boxed{f'(x) = \frac{6}{\sqrt{x}} - 6x^2 - \frac{10}{x^3}}$$

$$f(x) = 8x^{\frac{3}{2}} - 2x^3 + 5x^{-2}$$

$$f'(x) = 6x^{\frac{1}{2}} - 6x^2 - 10x^{-3}$$

$$f'(x) = \frac{6}{\sqrt{x}} - 6x^2 - \frac{10}{x^3}$$

$$\begin{aligned} \textcircled{1} \quad f(x) &= 2(1-3x^2)^5 \\ f'(x) &= 10(1-3x^2)^4(-6x) \\ f'(x) &= -60x(1-3x^2)^4 \end{aligned}$$

$$\begin{aligned} \textcircled{2} \quad f(x) &= (4x-1)^{\frac{1}{2}} \\ f'(x) &= \frac{1}{2}(4x-1)^{-\frac{1}{2}}(4) \\ f'(x) &= \frac{1(4)}{2(4x-1)^{\frac{1}{2}}} \end{aligned}$$

b) $f(x) = 2(1-3x^2)^5 + \sqrt{4x-1}$ (10 points)

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

$$\boxed{f'(x) = -60x(1-3x^2)^4 + \frac{2}{\sqrt{4x-1}}}$$

$$\textcircled{1} \quad f'(x) = 2(1-3x^2)^5$$

$$f'(x) = 10(1-3x^2)^4(-6x)$$

$$f'(x) = -60x(1-3x^2)^4$$

$$\textcircled{2} \quad f'(x) = (4x-1)^{\frac{1}{2}}$$

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

$$f'(x) = \frac{2}{2\sqrt{4x-1}}$$

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

$$f'(x) = \frac{4}{2\sqrt{4x-1}}$$

$$f'(x) = \frac{2}{\sqrt{4x-1}}$$

c) $f(x) = 7(4x-5x^3)^6$ (10 points)

$$f'(x) = 42(4x-5x^3)^5(4-15x^2)$$

$$f'(x) = 42(4-15x^2)(4x-5x^3)^5$$

$$f'(x) = 168 - 630x^2(4x-5x^3)^5$$

$$f(x) = 7(4x-5x^3)^6$$

$$f'(x) = 42(4x-5x^3)^5(4-15x^2)$$

$$\begin{aligned} 42(4-15x^2) &= 168 - 630x^2 \\ &= -630x^2 + 168 \end{aligned}$$

$$\boxed{f'(x) = 42(4-15x^2)(4x-5x^3)^5}$$