

What month is your birthday ?

What are the first 2 digits of your address ?

What are the last 2 digits of your zip code ?

What are the last 2 digits of your social security number ?

**[IF YOU DO NOT HAVE A SOCIAL SECURITY NUMBER,
USE YOUR STUDENT ID NUMBER]**

NO CALCULATORS ALLOWED

The amount you spend on light bulbs each year depends on how many hours a day you use them. Let $A = f(u)$, **SCORE: ___ / 2 POINTS** where A is the amount spent (in dollars), and u is the daily usage of the lightbulb (in hours). Give the practical meaning, including units, for the statement $f'(5) = 10$.

IF A LIGHTBULB IS USED 5 HOURS A DAY,
YOU WILL NEED TO SPEND \$10 MORE EACH YEAR
FOR EACH ADDITIONAL HOUR YOU USE THEM DAILY.

A decorative horizontal border consisting of a repeating pattern of stylized floral and geometric motifs, including stars, flowers, and triangles.

State the Intermediate Value Theorem.

SCORE: / 1 POINTS

SEE YOUR TEXTBOOK/NOTES

$$\text{Let } f(x) = \frac{x^2 - 2x + 7}{1 - 2x}.$$

SCORE: / 5 POINTS

- [a] Find $f'(x)$. **SIMPLIFY YOUR ANSWER.**

$$\begin{aligned}
 & \text{Find } f'(x). \underline{\text{SIMPLIFY YOUR ANSWER.}} \\
 f'(x) &= \frac{(2x-2)(1-2x) - (x^2-2x+7)(-2)}{(1-2x)^2} \quad]_2 \\
 &= \frac{2x-4x^2-2+4x+2x^2-4x+14}{(1-2x)^2} \\
 &= \frac{-2x^2+2x+12}{(1-2x)^2} \quad]_1
 \end{aligned}$$

- [b] Are there any points on the curve $y = f(x)$ where the tangent line is horizontal? If so, find them. If not, explain briefly why not.

$$\boxed{f'(x) = 0} \text{ IF } \frac{-2x^2 + 2x + 12 = 0}{\frac{1}{2} x^2 - x - 6 = 0} \text{ AND } (1-2x)^2 \neq 0$$

$$(x-3)(x+2) = 0$$

$$\frac{1}{2} \boxed{x = 3, -2}$$

Using the definition of the derivative, find the derivative of $f(x) = \frac{x}{3x+2}$.

SCORE: ___ / 3 POINTS

$$f'(x) = \lim_{h \rightarrow 0} \left[\frac{\frac{x+h}{3(x+h)+2} - \frac{x}{3x+2}}{h} \right] \boxed{1}$$

$$= \lim_{h \rightarrow 0} \left[\frac{(x+h)(3x+2) - x(3x+3h+2)}{h(3x+3h+2)(3x+2)} \right] \boxed{1}$$

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

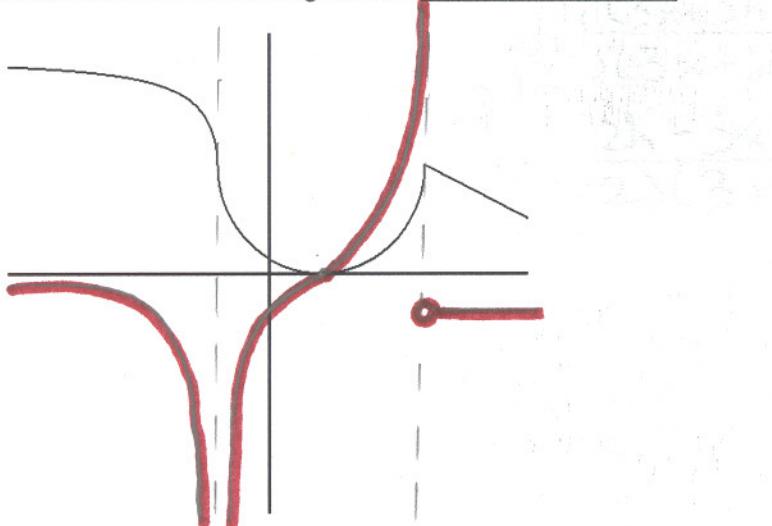
$-\frac{1}{2}$ IF YOU FORGOT

$$= \lim_{h \rightarrow 0} \frac{2}{(3x+3h+2)(3x+2)} = \frac{2}{(3x+2)^2} \boxed{\frac{1}{2}}$$

" $\lim_{h \rightarrow 0}$ " AT ANY POINT

Sketch the derivative of the following function on the same set of axes.

SCORE: ___ / 3 POINTS



Find the requested derivatives.

SCORE: ___ / 6 POINTS

- [a] If $f(x) = (e^2 - 2x^3 + 3x^4)5^x$, find $f'(0)$.

$$f'(x) = (-6x^2 + 12x^3)5^x + (e^2 - 2x^3 + 3x^4)(\ln 5)5^x \boxed{2}$$

$$f'(0) = 0 \cdot 1 + e^2 \ln 5 \cdot 1 \\ = e^2 \ln 5 \boxed{1}$$

- [b] If $f(t) = \frac{(4+t)^2}{\sqrt{t}}$, find $f''(t)$.

$$f(t) = (16 + 8t + t^2)t^{-\frac{1}{2}}$$

$$= 16t^{-\frac{1}{2}} + 8t^{\frac{1}{2}} + t^{\frac{3}{2}}$$

$$f'(t) = \frac{-8t^{-\frac{3}{2}} + 4t^{-\frac{1}{2}} + \frac{3}{2}t^{\frac{1}{2}}}{t^{\frac{1}{2}}} \boxed{1\frac{1}{2}}$$

$$f''(t) = \frac{12t^{-\frac{5}{2}} - 2t^{-\frac{3}{2}} + \frac{3}{4}t^{-\frac{1}{2}}}{t^{\frac{1}{2}}} \boxed{1\frac{1}{2}}$$