

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

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.

SCORE: / 1 POINTS

SEE YOUR TEXTBOOK/NOTES

A decorative border at the bottom of the page features a repeating pattern of stylized stars and floral motifs.

SCORE: / 5 POINTS

Find $f'(x)$. **SIMPLIFY YOUR ANSWER.**

$$\begin{aligned} f'(x) &= \frac{(2x-2)(1-2x) - (x^2-2x+7)(-2)}{(1-2x)^2} \\ &= \frac{2x - 4x^2 - 2 + 4x + 2x^2 - 4x + 14}{(1-2x)^2} \\ &= \frac{-2x^2 + 2x + 12}{(1-2x)^2} \end{aligned}$$

$$\underbrace{f'(x) = 0}_1 \quad \text{IF } \underbrace{-2x^2 + 2x + 12 = 0}_{\frac{1}{2}} \quad \text{AND } (1-2x)^2 \neq 0$$
$$x^2 - x - 6 = 0$$
$$(x-3)(x+2) = 0$$
$$\underbrace{x = 3, -2}_{\frac{1}{2}}$$

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

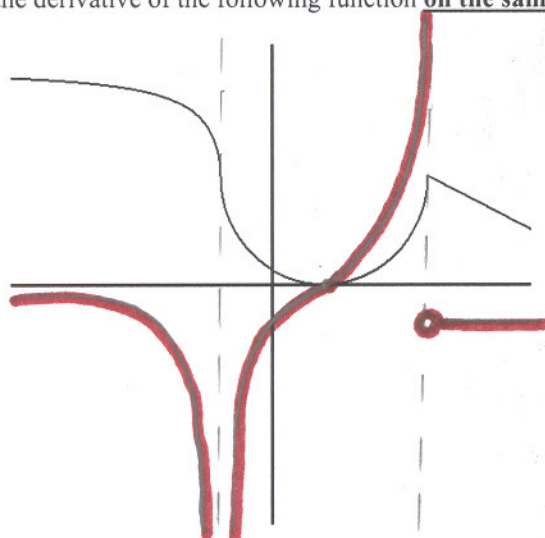
SCORE: ___ / 3 POINTS

$$\begin{aligned}
 f'(x) &= \lim_{h \rightarrow 0} \frac{\frac{x+h}{3(x+h)+2} - \frac{x}{3x+2}}{h} \\
 &= \lim_{h \rightarrow 0} \frac{(x+h)(3x+2) - x(3x+3h+2)}{h(3x+3h+2)(3x+2)} \\
 &= \lim_{h \rightarrow 0} \frac{\cancel{3x^2} + 2x + \cancel{3xh} + 2h - \cancel{3x^2} - 3xh - \cancel{2x}}{h(3x+3h+2)(3x+2)} \\
 &= \lim_{h \rightarrow 0} \frac{2}{(3x+3h+2)(3x+2)} = \frac{2}{(3x+2)^2}
 \end{aligned}$$

$-\frac{1}{2}$ IF YOU FORGOT
 "lim"
 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 $f'(0)$.

$$\begin{aligned}
 f'(x) &= (-6x^2 + 12x^3)5^x \\
 &\quad + (e^2 - 2x^3 + 3x^4)(\ln 5)5^x \\
 f'(0) &= 0 \cdot 1 + e^2 \ln 5 \cdot 1 \\
 &= e^2 \ln 5
 \end{aligned}$$

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

$$\begin{aligned}
 f(t) &= (16 + 8t + t^2)t^{-\frac{1}{2}} \\
 &= 16t^{-\frac{1}{2}} + 8t^{\frac{1}{2}} + t^{\frac{3}{2}} \\
 f'(t) &= -8t^{-\frac{3}{2}} + 4t^{-\frac{1}{2}} + \frac{3}{2}t^{\frac{1}{2}} \\
 f''(t) &= 12t^{-\frac{5}{2}} - 2t^{-\frac{3}{2}} + \frac{3}{4}t^{-\frac{1}{2}}
 \end{aligned}$$