Today's Plan:

Learning Target (standard): I will find higher order derivatives using algebraic rules to find the derivative of a function.

Students will: Complete practice problems over previous concepts at the boards, put up homework problems on the board and make neccessary corrections to their own work, take notes over new material and complete practice problems over new concepts.

Teacher will: Provide practice problems over previous concepts, check homework problems for accuarcy and provide students feedback, describe and provide examples of new concepts and assign students assessment problems over new concepts.

Assessment: Board work, homework check and homework assignment

Differentiation: Students will work at the board, go over and correct homework at their seats, actively engage in lecture over new concepts, practice new concepts with the aid of other students and the teacher and complete homework assignment.

Implicit Differentiation:

$1) y' = \frac{6x}{6y^2+1}$

$2) y' = \frac{4}{-9y^2+4}$

$3) y' = \frac{3x^2}{-12y^2+5}$

$4) y' = \frac{-15x^2y^3+1}{15x^3y^2-3y^2}$

$5) y' = \frac{15x^2-8xy^2}{8x^2y+4}$

$6) y' = \frac{-6y-10}{3x}$

$7) y' = \frac{3x+4xy}{-2x^2+4y}$

$8) y' = \frac{12x-9xy^3-2y}{x+9x^2y^2}$

$9) y' = \frac{-y^3+1}{3xy^2-1}$

$10) y' = \frac{-6xy^2+5}{6x^2y}$

Find y'.

$$\frac{4x^2 - 5xy^2}{2xy} = 3$$

$4x^2 - 5xy^2 = 6xy$

$8x - 5y^2 - 10xyy' = 6y + 6xy'$

$-10xyy' - 6xy' = -8x + 5y^2 + 6y$

$y'(-10xy - 6x) = -8x + 5y^2 + 6y$

$$y' = \frac{-8x + 5y^2 + 6y}{-10xy - 6x}$$

$$y' = \frac{8x - 5y^2 - 6y}{6x + 10xy}$$

Find y'.

$$\left(\sqrt{2xy - 3y^2}\right)^2 = (4x)^2$$

$2xy - 3y^2 = 16x^2$

$2y + 2xy' - 6yy' = 32x$

$2xy' - 6yy' = 32x - 2y$

$y'(2x - 6y) = 32x - 2y$

$$y' = \frac{32x - 2y}{2x - 6y}$$

$$y' = \frac{16x - y}{x - 3y}$$

Find y'.

$$\frac{xy+3x^2}{y^3}=4$$

$$xy+3x^2=4y^3$$

$$y+xy'+6x=12y^2y'$$

$$xy'-12y^2y'=-6x-y$$

$$y'(x-12y^2)=-6x-y$$

$$y'=\frac{-6x-y}{x-12y^2}$$

Find the derivative.

$$y=(2x-3)^{-4}(x^2+5)^{-3}$$

$$y'=-4(2x-3)^{-5}(2)(x^2+5)^{-3}-3(x^2+5)^{-4}(2x)(2x-3)^{-4}$$

$$=-8(2x-3)^{-5}(x^2+5)^{-3}-6x(x^2+5)^{-4}(2x-3)^{-4}$$

$$=-2(2x-3)^{-5}(x^2+5)^{-4}\left[4(x^2+5)+3x(2x-3)\right]$$

$$=-2(2x-3)^{-5}(x^2+5)^{-4}(4x^2+20+6x^2-9x)$$

$$y'=-2(2x-3)^{-5}(x^2+5)^{-4}(10x^2-9x+20)$$

Find the derivative.

$$f(x)=\sqrt[3]{\frac{3x-4}{x+2}}=\left(\frac{3x-4}{x+2}\right)^{\frac{1}{3}}$$

$$f'(x)=\frac{1}{3}\left(\frac{3x-4}{x+2}\right)^{-\frac{2}{3}}\left[\frac{3(x+2)-1(3x-4)}{(x+2)^2}\right]$$

$$=\frac{1}{3}\left(\frac{x+2}{3x-4}\right)^{\frac{2}{3}}\left[\frac{3x+6-3x+4}{(x+2)^2}\right]$$

$$=\frac{1}{3}\left(\frac{x+2}{3x-4}\right)^{\frac{2}{3}}\left[\frac{10}{(x+2)^2}\right]$$

$$=\frac{10}{3(3x-4)^{\frac{2}{3}}(x+2)^{\frac{4}{3}}}$$

$$f'(x)=\frac{10}{3\sqrt[3]{(3x-4)^2(x+2)^4}}$$

Higher Order Derivatives:

- derivatives of derivatives of derivatives...
- the second derivative is the rate of change of the first derivative
- the third derivative is the rate of change of the second derivative

$s(t)=$ position

$s'(t)=v(t)=$ velocity

$s''(t)=v'(t)=a(t)=$ acceleration

$s'''(t)=v''(t)=a'(t)=$ jerk

Higher Order Derivatives:

- 2nd Derivative: $f''(x)$ $\frac{d^2y}{dx^2}$ y'' $D_x^2 y$
- 3rd Derivative: $f'''(x)$ $\frac{d^3y}{dx^3}$ y''' $D_x^3 y$
- 4th Derivative: $f^{(4)}(x)$ $\frac{d^4y}{dx^4}$ $y^{(4)}$ $D_x^4 y$

Find the fourth derivative:

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

$f'(x) = 12x^2 + 12x - 3$

$f''(x) = 24x + 12$

$f'''(x) = 24$

$f^{(4)}(x) = 0$

Find the second derivative:

$x^2 + y^2 = 1$

$2x + 2yy' = 0$

$2yy' = -2x$

$y' = \frac{-2x}{2y}$

$y' = -\frac{x}{y}$

$y' = -\frac{x}{y}$

$y' = -xy^{-1}$

$y'' = -y^{-1} + xy^{-2}y'$

$y'' = -y^{-1} + xy^{-2}(-xy^{-1})$

$y'' = -y^{-1} - x^2y^{-3}$

$y'' = -\frac{1}{y} - \frac{x^2}{y^3}$

$y'' = -\frac{y^2}{y^3} - \frac{x^2}{y^3}$

$y'' = \frac{-y^2 - x^2}{y^3}$

$y'' = -\frac{y^2 + x^2}{y^3}$

$y'' = -\frac{1}{y^3}$

Find the second derivative:

$xy + 2x^2 \cdot y = 3$

$y + xy' + 4xy + 2x^2y' = 0$

$xy' + 2x^2y' = -4xy - y$

$y'(x + 2x^2) = -4xy - y$

$y' = \frac{-4xy - y}{2x^2 + x}$

$y' = (-4xy - y)(2x^2 + x)^{-1}$

$y'' = (-4y - 4xy' - y')(2x^2 + x)^{-1} - (2x^2 + x)^{-2}(4x + 1)(-4xy - y)$

Assignment:

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