

Evaluate the limit of the following:

1. $\lim_{x \rightarrow -1} \frac{x^3 + 5x + 6}{x + 1}$

= $\frac{(-1.0001)^3 + 5(-1.0001) + 6}{-1.0001 + 1} = \boxed{6}$

2. $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x^2 + 2x - 8}$

= $\frac{2.0001^2 - 4}{2.0001^2 + 2(2.0001) - 8} = \boxed{0.7 \text{ or } \frac{3}{4}}$

3. $\lim_{x \rightarrow 0} \frac{1}{x}$

= $\frac{1}{0.0001} = 10,000 = \boxed{\infty}$

4. $\lim_{x \rightarrow \infty} \frac{3x^2 - 2x + 4}{-2x^2 - 3x^3 + 2}$

= $\frac{3(99999)^2 - 2(99999) + 4}{-2(99999)^2 - 3(99999)^3 + 2} = \boxed{-1.5 \text{ or } -\frac{3}{2}}$

Determine the equation of the vertical, horizontal, or inclined asymptote(s) of the following functions.

5. $y = \frac{3x}{x-5}$

m+n; $y = \frac{3}{1} = 3$

$\boxed{y = 3}$ HA

$x-5=0$

$\boxed{x=5}$ VA

NO INCLINED ASYMPTOTE

6. $y = \frac{2x^4}{x^4 - 3x^2 - 1}$

m+n; $y = \frac{2}{1} = 2$

$\boxed{y = 2}$ HA

$x^4 - 3x^2 - 1 = 0$

$\boxed{x = \pm 1.618}$

$\boxed{x = \pm 0.557}$ VA

NO INCLINED ASYMPTOTE

7. $y = \frac{2x}{x^2 - 5}$

m < 0 $\boxed{y = 0}$ HA

$x^2 - 5$

$\boxed{x = \pm \sqrt{5}}$ VA

NO INCLINED ASYMPTOTE

8. $y = \frac{3x^2 + x - 1}{x - 1}$

m+n; **NO HORIZONTAL ASYMPTOTE**

$x-1=0$

$\boxed{x=1}$ VA

$\begin{array}{r} 3 \ 1 \ -1 \\ 3 \ 4 \ 1 \\ \hline 3 \ 4 \ 1 \end{array}$

$\therefore y = 3x + 4$

$\boxed{y = 3x + 4}$ LA

Determine dy/dx for the following:

9. $y = \sqrt{x^2} - 3\sqrt[3]{x} - 5$

$y = x^{1/2} - 3x^{1/3} - 5$

$\frac{dy}{dx} = \frac{1}{2}x^{-1/2} - x^{-2/3}$

$\boxed{\frac{dy}{dx} = \frac{1}{2}\sqrt{x} - \frac{1}{x^{2/3}}}$

10. $y = e^{\tan x}$

$\frac{dy}{dx} = \tan x \cdot e^{\tan x}$

$\frac{dy}{dx} = \sec^2 x \cdot e^{\tan x}$

$\boxed{\frac{dy}{dx} = e^{\tan x} \sec^2 x}$

11. $y = x^x$

$\ln y = x^x \ln x$

$\frac{dy}{dx} = x^x \left(\frac{1}{x} \right) + x \ln x$

$\frac{dy}{dx} = x^x (x + 2 \ln x) = x^x (1 + \ln(x^2))$

$\boxed{\frac{dy}{dx} = x^{x+1} (1 + \ln(x^2))}$

12. $x^4(y^2 - 2xy) = 0$

$3x^4 + 2y^2y' - [2y + 2xy'] = 0$

$3x^4 + 2y^2y' - 2y - 2xy' = 0$

$2y^2y' - 2xy' = 2y - 3x^4$

$y'(2y^2 - 2x) = 2y - 3x^4$

$\boxed{y' = \frac{2y - 3x^4}{2y^2 - 2x}}$

Differential Calculus Problems With Solution

Patrick Jones



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