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Final Exam

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(3). $\lim_{n\to\infty} \left(\sqrt{n^2+3n-2} - \sqrt{n^2-3}\right)$

$$\frac{\left(\sqrt{n^2+3n-2} - \sqrt{n^2-3}\right)\cdot\left(\sqrt{n^2+3n-2} + \sqrt{n^2-3}\right)}{\sqrt{n^2+3n-2} + \sqrt{n^2-3}}$$

$$\left(\sqrt{n^2+3n-2} - \sqrt{n^2-3}\right)\left(\sqrt{n^2+3n-2} + \sqrt{n^2-3}\right) = \left(\sqrt{n^2+3n-2}\right)^2 - \left(\sqrt{n^2-3}\right)^2 =$$

$$= \left(\sqrt{n^2+3n-2}\right)^2 = \left(\sqrt{n^2-3}\right)^2 \qquad n^2+3n-2 = n^2-3 \qquad = 3n+1.$$

$$\lim_{n\to\infty} \frac{3n+1}{\sqrt{n^2+3n-2}+\sqrt{n^2-3}} = \frac{\frac{3n}{n} + \frac{1}{n}^{\to 0}}{\sqrt{\frac{n^2}{n^2} + \frac{3n}{n^2}^{\to 0} - \frac{2}{n^2}^{\to 0}} + \sqrt{\frac{n^2}{n^2} - \frac{3}{n^2}^{\to 0}}} = \frac{3}{\sqrt{1}+\sqrt{1}} = \frac{3}{2} = 1{,}5$$

(4). $e^{x^3y} + \sin x^2 = y^3 \qquad \frac{d}{dx}\left(e^{x^3y} + \sin x^2\right) = \frac{d}{dx}\left(y^3\right)$

$$\frac{d}{dx}\left(e^{x^3y} + \sin x^2\right) = e^{x^3y}\left(3x^2y + \frac{dy}{dx}x^3\right) + \cos x^2 \cdot 2x$$

$$\frac{d}{dx}\left(y^3\right) = 3y^2\frac{dy}{dx} \qquad e^{x^3y}\left(3x^2y + \frac{dy}{dx}x^3\right) + \cos x^2 \cdot 2x = 3y^2\frac{dy}{dx}$$

$$e^{x^3y}\left(3x^2y + y'x^3\right) + \cos x^2 \cdot 2x = 3y^2y' \qquad e^{x^3y}\left(3x^2y + y'x^3\right) + \cos x^2 \cdot 2x$$

$$e^{yx^3}\left(3yx^2 + x^3y'\right) + 2x\cos x^2 \qquad e^{x^3y}\left(3x^2y + y'x^3\right)$$

$$e^{x^3y}\cdot 3^{x^2y} + e^{x^3y}y'x^3 = 3e^{yx^3}yx^2 + e^{yx^3}x^3y$$

$$3e^{yx^3}yx^2+e^{yx^3}x^3y'+2x\cos x^2=3y^2y'$$

$$3e^{yx^3}yx^2+e^{yx^3}x^3y'+2x\cos x^2-(3e^{yx^3}yx^2+2x\cos x^2)=$$

$$=3y^2y'-(3e^{yx^3}yx^2+2x\cos x^2)$$

$$e^{yx^3}x^3y'=3y^2y'-3e^{yx^3}yx^2-2x\cos x^2-3y^2y'$$

$$e^{yx^3}x^3y'=-3e^{yx^3}yx^2-2x\cos x^2 \;/ e^{yx^3}x^3-3y^2$$

$$\frac{y'(e^{yx^3}x^3-3y^2)}{e^{yx^3}x^3-3y^2}=-\frac{3e^{yx^3}yx^2}{e^{yx^3}x^3-3y^2}-\frac{2x\cos x^2}{e^{yx^3}x^3-3y^2}$$

$$y'=\frac{-3e^{yx^3}yx^2-2x\cos x^2}{e^{yx^3}x^3-3y^2} \qquad \frac{dy}{dx}=\frac{-3e^{yx^3}yx^2-2x\cos x^2}{e^{yx^3}x^3-3y^2}$$

2. $\vec{p}=2i+k \qquad \vec{q}=i-2j+k \qquad \vec{r}=-2i+4j-3k.$

$$(\vec{q}\times\vec{r})=\begin{vmatrix} i & j & k \\ 1 & -2 & 1 \\ -2 & 4 & -3 \end{vmatrix} \Rightarrow i(6-4)-j(-3+2)+k(4-4)=2i-j$$

$$\vec{p}\times(\vec{q}\times\vec{r})\begin{vmatrix} i & j & k \\ 2 & 0 & 1 \\ 2 & 1 & 0 \end{vmatrix}=i(0-1)-j(0-2)+k(2+0)=-i+2j+2k$$

$$\|\vec{p}\times(\vec{q}\times\vec{r})\|=\sqrt{1+4+4}=\sqrt{9}=3$$