If $f(x) = \tan^4(3x)$, then $f'(x) =$

(A) $12 \tan^3(3x) \sec^2(3x)$

(B) $4 \tan^3(3x) \sec^2(3x)$

(C) $12 \tan^3(3x)$

(D) $4 \tan^3(3x)$

(E) $12 \tan^3(3x) \sec^2(x)$

$f(x) = [\tan(3x)]^4$ (chain rule)

$f'(x) = 4\tan^3(3x) \cdot \sec^2(3x) \cdot 3$

$= 12\tan^3(3x) \cdot \sec^2(3x)$ $\boxed{A}$

If $f(x) = \begin{cases} x^2 - x & \text{if} \quad x \neq 3 \\ 10 & \text{if} \quad x = 3 \end{cases}$, then

(A) $f'(3) = 1$

(B) $f'(3) = 5$

(C) $f'(3) = -5$

(D) $f'(3) = 0$

(E) $f(x)$ is not differentiable at $x = 3$

Check of continuity

$f(3) = 10$

$\lim_{x \to 3} f(x) = 9 - 3 = 6$

→ Not continuous

So not differentiable $\boxed{C}$

If $f(x) = \cos(3x)$, then $f^{(77)}(x) =$

(A) $3^{77}\ \cos(3x)$

(B) $3^{77}\ \sin(3x)$

(C) $-3^{77}\ \cos(3x)$

(D) $-3^{77}\ \sin(3x)$

(E) $-\sin(3x)$

$f(x) = \cos(3x)$, $f^{(77)}(x)$

$f'(x) = -\sin 3x$

$f^{(77)}(x) = -3^{77} \sin(3x)$

$$\begin{array}{r|l} & \;19 \\ \hline 4 & \;77 \\ & \;4 \\ \hline & \;37 \\ & \;36 \\ \hline & \;\boxed{1} \end{array}$$

The Linear approximation (linearization) of

$f(x) = \log_2(x)$ at $x = 16$ is

(A) $y = 4 + \frac{1}{8\ln(2)}(x - 16)$

(B) $y = 4 + \frac{1}{16\ln(2)}(x - 16)$

(C) $y = 8 + \frac{1}{16\ln(2)}(x - 16)$

(D) $y = 4 + \frac{1}{16\ln(2)}(x - 2)$

(E) $y = \frac{1}{16\ln(2)} + 4(x - 16)$

$f(x) = \log_2(x)$, $x = 16$

here $x = a = 16$ (عدد يعرف اجابته)

So, $f(a) = \log_2 16 = \log_2 2^4 = 4$

$f'(x) = \dfrac{1}{x \ln 2}$, $f'(4) = \dfrac{1}{8\ln(2)}$

$\Rightarrow \quad y = f(a) + f'(a)(x-a)$

$= 4 + \dfrac{1}{8\ln(2)}(x-16)$ $\boxed{A}$

The tangents to the curve $xy - x^2 + 12 = y^2$ are horizontal at the points

(A) $(4, 2)$ and $(-4, -2)$

(B) $(2, -4)$ and $(-2, 4)$

(C) $(0, -\sqrt{12})$ and $(0, \sqrt{12})$

(D) $(-\sqrt{12}, 0)$ and $(\sqrt{12}, 0)$

(E) $(2, 4)$ and $(-2, -4)$

Tangent are horizontal $\rightsquigarrow m = f'(x) = y' = 0$

الميل = صفر

$$Xy - x^2 + 12 = y^2$$

Implicit diff.

$$Xy' + y - 2x + 0 = 2yy'$$

$\boxed{\text{let } y' = 0}$

$$y - 2x = 0$$

$\boxed{y = 2x} \longrightarrow$ عوضها بالمعادلة الأصلية

$$X(2x) - x^2 + 12 = (2x)^2$$

$$\underbrace{2x^2 - x^2}_{x^2} + 12 = 4x^2$$

$$3x^2 = 12$$

$$x^2 = 4$$

$X = 4 \longrightarrow y = 8$

$X = -4 \longrightarrow y = -8$

$\boxed{A}$

If $f(x) = \cos^{-1}(x^4)$, then $f'(x) =$

(A) $-4x^3 \sin^{-1}(x^3)$

(B) $\frac{-4x^3}{\sqrt{1-x^2}}$

(C) $\frac{-4x^3}{1+x^8}$

(D) $\frac{-1}{\sqrt{1-x^8}}$

(E) $\frac{-4x^3}{\sqrt{1-x^8}}$

$$f(x) = \cos^{-1}(x^4)$$

$$\frac{\partial}{\partial x}(\cos^{-1} x) = \frac{-1}{\sqrt{1-x^2}}$$ مشتقة الزاوية

$$f'(x) = \frac{-1}{\sqrt{1-(x^4)^2}} \cdot 4x^3$$

$$f'(x) = \frac{-4x^3}{\sqrt{1-x^8}} = \boxed{D}$$

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If $f(x) = \tan^{-1}(2x)$, then $f'(x) =$

(A) $\frac{1}{1+4x^2}$

(B) $\frac{2}{1+x^2}$

(C) $\frac{2}{1+4x^2}$

(D) $\frac{2}{\sqrt{1-4x^2}}$

(E) $2(\sec^{-1}(2x))^2$

$f(x) = \tan^{-1}(2x)$

$$f'(x) = \frac{1}{1+(2x)^2} \cdot 2 = \frac{2}{1+4x^2} \Rightarrow \boxed{C}$$

If $f(x) = 5^x + x^{22}$, then $f^{(67)}(x) =$

(A) 0

(B) $(\ln(5))^{67}\ 5^x + 22!$

(C) $\ln(5)\ 5^x$

(D) 5^x

(E) $(\ln(5))^{67}\ 5^x$

$f(x) = 5^x + x^{22}$, $f^{(67)}(x) = ??$

$5^x \xrightarrow{f'} 5^x \ln 5 \xrightarrow{f''} 5^x \ln 5 . \ln 5 \; (5^x (\ln 5)^2)$

$f^{(67)}(x) = 5^x (\ln 5)^{67} \longrightarrow \boxed{E}$