Q1

If \( f(x) = x \cos^{-1}(2x) - \frac{1}{2} \sqrt{1 - 4x^2} \), then \( f'(x) = \)

\[
\frac{d}{dx} \left( x \cos^{-1}(2x) - \frac{1}{2} \sqrt{1 - 4x^2} \right) = \frac{2x}{\sqrt{1 - 4x^2}} - \frac{1}{2} \frac{-2x}{\sqrt{1 - 4x^2}} = \frac{2x - x}{\sqrt{1 - 4x^2}} = \frac{x}{\sqrt{1 - 4x^2}}
\]

(a) \( -1 \cos^{-1}(2x) \)

(b) \( \cos^{-1}(2x) \)

(c) \( \frac{1}{4} \cos^{-1}(2x) \)

(d) \( \cos^{-1}(2x) - \frac{x}{\sqrt{1 - 4x^2}} \)

(e) \( \frac{\cos^{-1}(2x)}{\sqrt{1 - 4x^2}} \)

Q2

If \( 1 + xy + y \cos y = e^{1-x} - \frac{\pi}{2} \), then \( y' \) at \( (1, -\frac{\pi}{2}) \) is equal

(a) \( \frac{\pi}{2} \)

(b) \( -1 \)

(c) \( 0 \)

(d) \( -2 \)

(e) \( 1 \)
If \( y = e^{\tan x} \), then \( y' \left( \frac{\pi}{4} \right) =

(a) 1

(b) \frac{\pi}{4} \ln \frac{\pi}{4}

(c) 1 + \frac{\pi}{4} \ln \frac{\pi}{4}

(d) \frac{\pi}{2} \ln \frac{\pi}{4}

(e) 1 + \frac{\pi}{2} \ln \frac{\pi}{4}

Q4

If \( y = 3^x \cdot x^3 \), then \( y'(1) =

(a) 6

(b) 9 + 3 \ln 3

(c) 12

(d) 9 + \ln 9

(e) 3 + 3 \ln 3

\ln y = x \ln 3 + 3 \ln x

\frac{y'}{y} = \ln 3 + 0 + \frac{3}{x}

\frac{5'}{5} = \ln 3 + \frac{3}{x}

\frac{y'}{y} = (3^x \cdot x^3) \left( \ln 3 + \frac{3}{x} \right)

\frac{y'}{y} \left( 1 \right) = (3 \cdot 1) \left( \ln 3 + 3 \right)

y'(1) = (3 \ln 3 + 9)
An equation of the tangent line to the curve \(xe^y = y - 1\) at \(x = 0\) is given by

(a) \(y = e \cdot x\)

(b) \(y = x + 1\)

(c) \(y = e \cdot x + 1\)

(d) \(y = 2e \cdot x + 1\)

Suppose that \(F(x) = f(g(x))\) and \(g(3) = 6, g'(3) = 4, f'(3) = 2\) and \(f'(6) = 7\). Then \(F'(3)\) is equal to

\[
F'(3) = f'(g(3)) \cdot g'(3)
\]

(a) 8

(b) 14

(c) 24

(d) 42

(e) 28
If \( y = \sin(u^2 - 4) \) and \( u = 2e^x - x \), then \( \left. \frac{dy}{dx} \right|_{x=0} = \)

\[
\sin(4e^{2x} - 4xe^x + x^2 - 4)
\]

(b) \( -4 \)

\[
\frac{dy}{dx} = \cos(4e^{2x} - 4xe^x + x^2 - 4)
\]

(c) \( -2 \)

\[
\frac{dy}{dx} \bigg|_{x=0} = \cos(8(1) - 0 + 0 - 4)
\]

(d) \( 0 \)

\[
\frac{dy}{dx} \bigg|_{x=0} = \cos(8(1) - 4(1) - 0 + 0)
\]

(e) \( 2 \)

If \( g(2x + 1) = \sqrt{x^2 + 8x} \), then \( g'(3) = \)

\[
\frac{dy}{dx} \bigg|_{x=0} = \cos(8)
\]

(a) \( \frac{5}{3} \)

\[
g(2x + 1) = \sqrt{4x^2 + 12x + 1 + 16x^2 + 1}
\]

(b) \( \frac{5}{6} \)

\[
g'(3) = \frac{8x + 12}{\sqrt{4x^2 + 12x + 1 + 16x^2 + 1}}
\]

(c) \( \frac{7}{2\sqrt{37}} \)

\[
g'(3) = \frac{8(3) + 12}{\sqrt{2(9) + 2(36) + 1 + 16}}
\]

(d) \( \frac{7}{\sqrt{37}} \)

\[
\frac{8(3) + 12}{2 \sqrt{2(9) + 2(36) + 1}}
\]

(e) \( \frac{5}{12} \)

\[
\frac{8x + 12}{2 \sqrt{36 + 48 + 1}}
\]