Name: __________________________

ID: ______________ Sec: _____________.

Check that this exam has 15 questions.

Important Instructions:

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7. When bubbling, make sure that the bubbled space is fully covered.

8. When erasing a bubble, make sure that you do not leave any trace of penciling.
1. The $x$-intercept of the tangent line to the curve $y = x\sqrt{x^2 - 8}$ at $x = -3$ is given by

(a) $x = -27$
(b) $x = 27$
(c) $x = \frac{27}{10}$
(d) $x = 10$
(e) $x = \frac{27}{10}$

2. The values of $x$ for which the function $f(x) = x + 2\sin x$ has tangent lines parallel to the line $2x + 2y = 5$ are

(a) $(2k + 1)\pi$, $k$ is an integer
(b) $2k\pi$, $k$ is an integer
(c) $k\pi$, $k$ is an integer
(d) $(k + 1)\pi$, $k$ is an integer
(e) none of the above
3. If \( y = \arctan(\arcsin \sqrt{x}) \), then \( \frac{dy}{dx} = \)

(a) \( \frac{1}{\sqrt{1 - x^2}[1 + \arcsin x]} \)

(b) \( \frac{1}{\sqrt{1 - x^2}[1 + (\arcsin \sqrt{x})^2]} \)

(c) \( \frac{1}{1 + (\arcsin \sqrt{x})^2} \)

(d) \( \frac{1}{2\sqrt{x}\sqrt{1 - x}[1 + (\arcsin \sqrt{x})^2]} \)

(e) \( \frac{1}{\sqrt{1 - x}[1 + (\arcsin \sqrt{x})^2]} \)

4. If \( f(4) = \frac{1}{4} \), \( f'(4) = -\frac{1}{4} \) and \( g(x) = \frac{1 + xf(x)}{\sqrt{x}} \), then \( g'(4) = \)

(a) \( -\frac{1}{2} \)

(b) \( \frac{5}{8} \)

(c) \( -\frac{5}{8} \)

(d) \(-1\)

(e) \( 0 \)
5. Suppose that $L$ is a function such that $L'(x) = \frac{1}{x}$ for $x > 0$. Then the derivative of $F(x) = L(x^4) + L\left(\frac{1}{x}\right)$ is equal to

(a) $x^4 - x$

(b) $\frac{5}{x}$

(c) $x^3$

(d) $\frac{3}{x}$

(e) $\frac{4}{x^3}$

6. If $u = \sqrt[3]{t^2} + 2\sqrt{t^3}$, then $\frac{du}{dt}$ is equal to

(a) $\frac{2 + 4\sqrt[4]{t^5}}{5\sqrt[5]{t^5}}$

(b) $\frac{2 + 9\sqrt[9]{t^5}}{3\sqrt[3]{t}}$

(c) $\frac{6 + 4\sqrt[t^4]}{6\sqrt[t]}$

(d) $\frac{9 + 4\sqrt[t^4]}{5\sqrt[5]{t}}$

(e) $\frac{2 + 3\sqrt[t]}{6\sqrt[6]{t^3}}$
7. If \( y = \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \), then \( y' \) is equal to

(a) \[ \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \left[ 2 \sec x + \frac{4 \sec x}{\sin x} - \frac{8x}{x^2 + 1} \right] \]

(b) \[ \frac{\sin^2 x \sec^8 x}{\cos^4 x(x^2 + 1)^2} \left[ \cot x + 5 \sec x \frac{\sin x}{\sin x} - \frac{6x}{x^2 + 1} \right] \]

(c) \[ \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \left[ 2 \cot x + \frac{4 \sec^2 x}{\tan x} - \frac{4x}{x^2 + 1} \right] \]

(d) \[ \frac{\sin^6 x}{\cos^4 x(x^2 + 1)^2} \left[ 2 \cot x + \frac{6 \cos x}{\cot x} - \frac{4x}{x^2 + 1} \right] \]

(e) \[ \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \left[ \cot x + \frac{8 \sec x}{\tan x} - \frac{3x}{x^2 + 1} \right] \]

8. \[ \lim_{x \to \pi/4} \frac{\sin x - \cos x}{\cos(2x)} \] is equal to

(a) 1

(b) \(-1\)

(c) \(\sqrt{2}\)

(d) \(-\frac{\sqrt{2}}{2}\)

(e) 0
9. If \( g(x) = \sqrt{5 - 2x} \), then \( g'''(2) \) is equal to

(a) 2
(b) -1
(c) \(-\frac{1}{2}\)
(d) -3
(e) 1

10. \( \tanh(\ln x) = \)

(a) \( \frac{x^2 + 1}{1 - x^2} \)
(b) \( \frac{1 - x^2}{x^2 + 1} \)
(c) \( \frac{x^2 - 1}{x^2 + 1} \)
(d) \( \infty \)
(e) \( \frac{x^2 + 1}{x^2 - 1} \)
11. If \((x - y)^2 = x + y\), then

(a) \(\frac{dy}{dx} = \frac{2x - 2y + 1}{2x - 2y - 1}\)

(b) \(\frac{dy}{dx} = \frac{2x - 2y - 1}{2x + 2y + 1}\)

(c) \(\frac{dy}{dx} = \frac{2x - 2y - 1}{2x - 2y + 1}\)

(d) \(\frac{dy}{dx} = 2x - 2y - 1\)

(e) \(\frac{dy}{dx} = \frac{2x - 2y + 1}{2x + 2y + 1}\)

12. An equation of the normal line to the graph of \(y = x^x \cos x\) when \(x = \frac{\pi}{2}\) is given by

(a) \(2\pi(\ln \sqrt{\pi} - \ln \sqrt{2})(y - 1) = 2x - \pi\)

(b) \(\pi \ln \sqrt{\pi}(y - 1) = (\ln 2)x - \pi\)

(c) \((\ln \sqrt{\pi} - \ln \sqrt{2})(y - 1) = 2x - \pi\)

(d) \(\pi(\ln \sqrt{\pi} - \ln \sqrt{2})(y - \pi) = x - 1\)

(e) \(2\pi \ln(\pi - 2)(y - 1) = x - \pi\)
13. Which one of the following statements is true about the function \( f(x) = x|x|? \)

(a) \( f \) is not differentiable at \( x = 0 \)

(b) \( f'(-x) = -f'(x) \)

(c) \( f \) is differentiable on \((-\infty, \infty)\) and \( f'(x) = 2x \)

(d) \( f \) is differentiable on \((-\infty, \infty)\) and \( f'(x) = 2|x| \)

(e) \( f \) is differentiable on \((-\infty, \infty)\) and \( f'(x) = -2x \)

14. There are two lines through the point \( (2, -3) \) that are tangent to the parabola \( y = x^2 + x \). Then the sum of the slopes of these lines is

(a) 11

(b) 13.5

(c) 7.5

(d) 10

(e) 9
15. If $\sqrt{x} + \sqrt{y} = 4$ defines implicitly a relation between $x$ and $y$, then $y''$ is equal to

(a) $\frac{\sqrt{xy}}{2x^2y}(x + y)$

(b) $\frac{xy + y\sqrt{xy}}{2x^2y}$

(c) $-\frac{\sqrt{y}}{x}$

(d) $-\frac{\sqrt{x}}{y}$

(e) $\frac{x\sqrt{y} + y\sqrt{x}}{2x^2}$
King Fahd University of Petroleum and Minerals
Department of Mathematical Sciences

Math 101
Exam 2

061
Tuesday 28/11/2006
Net Time Allowed: 90 minutes

Name: ________________________________
ID: ___________________ Sec: ________________

Check that this exam has 15 questions.

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1. The $x$-intercept of the tangent line to the curve $y = x\sqrt{x^2 - 8}$ at $x = -3$ is given by

(a) $x = \frac{27}{10}$
(b) $x = 27$
(c) $x = -\frac{27}{10}$
(d) $x = -27$
(e) $x = 10$

2. If $f(4) = \frac{1}{4}$, $f'(4) = -\frac{1}{4}$ and $g(x) = \frac{1 + xf(x)}{\sqrt{x}}$, then $g'(4) =$

(a) $-1$
(b) $-\frac{5}{8}$
(c) $\frac{5}{8}$
(d) $0$
(e) $-\frac{1}{2}$
3. If \( u = \sqrt[3]{t^2} + 2\sqrt[5]{t^3} \), then \( \frac{du}{dt} \) is equal to

(a) \( \frac{6 + 4\sqrt[5]{t^4}}{6\sqrt[3]{t^3}} \)

(b) \( \frac{2 + 3\sqrt[5]{t^4}}{6\sqrt[3]{t^3}} \)

(c) \( \frac{9 + 4\sqrt[5]{t^4}}{5\sqrt[3]{t^5}} \)

(d) \( \frac{2 + 9\sqrt[5]{t^5}}{3\sqrt[3]{t^5}} \)

(e) \( \frac{2 + 4\sqrt[5]{t^5}}{5\sqrt[3]{t^5}} \)

4. If \( g(x) = \sqrt{5 - 2x} \), then \( g'''(2) \) is equal to

(a) \( -\frac{1}{2} \)

(b) 2

(c) \( -3 \)

(d) 1

(e) \( -1 \)
5. If \( y = \arctan(\arcsin \sqrt{x}) \), then \( \frac{dy}{dx} = \)

(a) \( \frac{1}{1 + (\arcsin \sqrt{x})^2} \)

(b) \( \frac{1}{\sqrt{1 - x^2}[1 + \arcsin x]} \)

(c) \( \frac{1}{\sqrt{1 - x^2}[1 + (\arcsin \sqrt{x})^2]} \)

(d) \( \frac{1}{2\sqrt{x}\sqrt{1 - x}[1 + (\arcsin \sqrt{x})^2]} \)

(e) \( \frac{1}{\sqrt{1 - x}[1 + (\arcsin \sqrt{x})^2]} \)

6. \( \lim_{x \to \pi/4} \frac{\sin x - \cos x}{\cos(2x)} \) is equal to

(a) 0

(b) \( \sqrt{2} \)

(c) -1

(d) 1

(e) \( -\frac{\sqrt{2}}{2} \)
7. $\tanh(\ln x) = $

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

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

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

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

(e) $\infty$

8. Suppose that $L$ is a function such that $L'(x) = \frac{1}{x}$ for $x > 0$. Then the derivative of $F(x) = L(x^4) + L\left(\frac{1}{x}\right)$ is equal to

(a) $\frac{4}{x^3}$

(b) $x^4 - x$

(c) $\frac{5}{x}$

(d) $\frac{3}{x}$

(e) $x^3$
9. If \( y = \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \), then \( y' \) is equal to

(a) \( \frac{\sin^6 x}{\cos^4 x (x^2 + 1)^2} \left[ 2 \cot x + \frac{6 \cos x}{\cot x} - \frac{4x}{x^2 + 1} \right] \)

(b) \( \frac{\sin^2 x \sec^8 x}{\cos^4 x (x^2 + 1)^2} \left[ \cot x + \frac{5 \sec x}{\sin x} - \frac{6x}{x^2 + 1} \right] \)

(c) \( \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \left[ \cot x + \frac{8 \sec x}{\tan x} - \frac{3x}{x^2 + 1} \right] \)

(d) \( \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \left[ 2 \sec x + \frac{4 \sec^2 x}{\sin x} - \frac{8x}{x^2 + 1} \right] \)

(e) \( \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \left[ 2 \cot x + \frac{4 \sec^2 x}{\tan x} - \frac{4x}{x^2 + 1} \right] \)

10. The values of \( x \) for which the function \( f(x) = x + 2 \sin x \) has tangent lines parallel to the line \( 2x + 2y = 5 \) are

(a) \( 2k\pi, \ k \) is an integer

(b) \( k\pi, \ k \) is an integer

(c) none of the above

(d) \( (k + 1)\pi, \ k \) is an integer

(e) \( (2k + 1)\pi, \ k \) is an integer
11. An equation of the normal line to the graph of \( y = x^x \cos x \) when \( x = \frac{\pi}{2} \) is given by

(a) \( (\ln \sqrt{\pi} - \ln \sqrt{2})(y - 1) = 2x - \pi \)

(b) \( \pi(\ln \sqrt{\pi} - \ln \sqrt{2})(y - \pi) = x - 1 \)

(c) \( 2\pi(\ln \sqrt{\pi} - \ln \sqrt{2})(y - 1) = 2x - \pi \)

(d) \( 2\pi \ln(\pi - 2)(y - 1) = x - \pi \)

(e) \( \pi \ln \sqrt{\pi}(y - 1) = (\ln 2)x - \pi \)

12. If \( \sqrt{x} + \sqrt{y} = 4 \) defines implicitly a relation between \( x \) and \( y \), then \( y'' \) is equal to

(a) \( \frac{x \sqrt{y} + y \sqrt{x}}{2x^2} \)

(b) \( \frac{xy + y \sqrt{xy}}{2x^2y} \)

(c) \( -\frac{x}{\sqrt{y}} \)

(d) \( -\frac{\sqrt{y}}{x} \)

(e) \( \frac{\sqrt{xy}}{2x^2y}(x + y) \)
13. There are two lines through the point \((2, -3)\) that are tangent to the parabola \(y = x^2 + x\). Then the **sum** of the slopes of these lines is

(a) 10

(b) 13.5

(c) 9

(d) 11

(e) 7.5

14. If \((x - y)^2 = x + y\), then

(a) \[\frac{dy}{dx} = \frac{2x - 2y - 1}{2x - 2y + 1}\]

(b) \[\frac{dy}{dx} = \frac{2x - 2y + 1}{2x - 2y - 1}\]

(c) \[\frac{dy}{dx} = \frac{2x - 2y - 1}{2x + 2y + 1}\]

(d) \[\frac{dy}{dx} = \frac{2x - 2y + 1}{2x + 2y + 1}\]

(e) \[\frac{dy}{dx} = 2x - 2y - 1\]
15. Which one of the following statements is true about the function \( f(x) = x|x|? \)

(a) \( f \) is differentiable on \((-\infty, \infty)\) and \( f'(x) = 2|x| \)

(b) \( f \) is not differentiable at \( x = 0 \)

(c) \( f \) is differentiable on \((-\infty, \infty)\) and \( f'(x) = -2x \)

(d) \( f \) is differentiable on \((-\infty, \infty)\) and \( f'(x) = 2x \)

(e) \( f'(-x) = -f'(x) \)
King Fahd University of Petroleum and Minerals  
Department of Mathematical Sciences

CODE 003 Math 101 CODE 003
Exam 2
061
Tuesday 28/11/2006
Net Time Allowed: 90 minutes

Name: ____________________________________________

ID: ________________ Sec: ________________

Check that this exam has 15 questions.

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1. If \( f(4) = \frac{1}{4} \), \( f'(4) = -\frac{1}{4} \) and \( g(x) = \frac{1 + x f(x)}{\sqrt{x}} \), then \\
g'(4) = \\
(a) \quad -\frac{5}{8} \\
(b) \quad 0 \\
(c) \quad -\frac{1}{2} \\
(d) \quad \frac{5}{8} \\
(e) \quad -1 \\

2. If \( y = \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \), then \( y' \) is equal to \\

(a) \quad \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \left[ \cot x + \frac{8 \sec x}{\tan x} - \frac{3x}{x^2 + 1} \right] \\

(b) \quad \frac{\sin^6 x}{\cos^4 x(x^2 + 1)^2} \left[ 2 \cot x + \frac{6 \cos x}{\cot x} - \frac{4x}{x^2 + 1} \right] \\

(c) \quad \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \left[ 2 \sec x + \frac{4 \sec^2 x}{\sin x} - \frac{8x}{x^2 + 1} \right] \\

(d) \quad \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \left[ 2 \cot x + \frac{4 \sec^2 x}{\tan x} - \frac{4x}{x^2 + 1} \right] \\

(e) \quad \frac{\sin^2 x \sec^8 x}{\cos^4 x(x^2 + 1)^2} \left[ \cot x + \frac{5 \sec x}{\sin x} - \frac{6x}{x^2 + 1} \right]
3. The values of $x$ for which the function $f(x) = x + 2\sin x$ has tangent lines parallel to the line $2x + 2y = 5$ are

(a) $(2k + 1)\pi$, $k$ is an integer

(b) none of the above

(c) $k\pi$, $k$ is an integer

(d) $(k + 1)\pi$, $k$ is an integer

(e) $2k\pi$, $k$ is an integer

4. $\lim_{x \to \pi/4} \frac{\sin x - \cos x}{\cos(2x)}$ is equal to

(a) $-\frac{\sqrt{2}}{2}$

(b) $0$

(c) $\sqrt{2}$

(d) $1$

(e) $-1$
5. \( \tanh(\ln x) = \)

(a) \( \frac{x^2 + 1}{1 - x^2} \)

(b) \( \frac{x^2 + 1}{x^2 - 1} \)

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

(d) \( \frac{1 - x^2}{x^2 + 1} \)

(e) \( \infty \)

6. If \( u = \sqrt{t^2} + 2\sqrt{t^3} \), then \( \frac{du}{dt} \) is equal to

(a) \( \frac{2 + 3\sqrt{t}}{6\sqrt{t^3}} \)

(b) \( \frac{2 + 9\sqrt{t^5}}{3\sqrt{t}} \)

(c) \( \frac{9 + 4\sqrt{t^4}}{5\sqrt{t}} \)

(d) \( \frac{6 + 4\sqrt{t^4}}{6\sqrt{t}} \)

(e) \( \frac{2 + 4\sqrt{t^5}}{5\sqrt{t^5}} \)
7. The $x$-intercept of the tangent line to the curve $y = x\sqrt{x^2 - 8}$ at $x = -3$ is given by

(a) $x = -27$

(b) $x = 10$

(c) $x = \frac{27}{10}$

(d) $x = \frac{27}{10}$

(e) $x = 27$

8. Suppose that $L$ is a function such that $L'(x) = \frac{1}{x}$ for $x > 0$.

Then the derivative of $F(x) = L(x^4) + L\left(\frac{1}{x}\right)$ is equal to

(a) $x^4 - x$

(b) $x^3$

(c) $\frac{5}{x}$

(d) $\frac{4}{x^3}$

(e) $\frac{3}{x}$
9. If \( y = \arctan(\arcsin \sqrt{x}) \), then \( \frac{dy}{dx} = \)

(a) \( \frac{1}{2\sqrt{x}\sqrt{1-x[1+(\arcsin \sqrt{x})^2]}} \)

(b) \( \frac{1}{\sqrt{1-x[1+(\arcsin \sqrt{x})^2]}} \)

(c) \( \frac{1}{\sqrt{1-x^2[1+(\arcsin \sqrt{x})^2]}} \)

(d) \( \frac{1}{\sqrt{1-x^2[1+\arcsin x]}} \)

(e) \( \frac{1}{1+(\arcsin \sqrt{x})^2} \)

10. If \( g(x) = \sqrt{5-2x} \), then \( g'''(2) \) is equal to

(a) \( -\frac{1}{2} \)

(b) 2

(c) −1

(d) 1

(e) −3
11. An equation of the normal line to the graph of \( y = x^x \cos x \) when \( x = \frac{\pi}{2} \) is given by

(a) \( \pi (\ln \sqrt{\pi} - \ln \sqrt{2})(y - \pi) = x - 1 \)

(b) \( 2\pi (\ln \sqrt{\pi} - \ln \sqrt{2})(y - 1) = 2x - \pi \)

(c) \( 2\pi \ln(\pi - 2)(y - 1) = x - \pi \)

(d) \( (\ln \sqrt{\pi} - \ln \sqrt{2})(y - 1) = 2x - \pi \)

(e) \( \pi \ln \sqrt{\pi}(y - 1) = (\ln 2)x - \pi \)

12. There are two lines through the point \((2, -3)\) that are tangent to the parabola \( y = x^2 + x \). Then the sum of the slopes of these lines is

(a) 9

(b) 13.5

(c) 10

(d) 7.5

(e) 11
13. Which one of the following statements is true about the function \( f(x) = x|x| \)?

(a) \( f \) is differentiable on \((-\infty, \infty)\) and \( f'(x) = 2x \)

(b) \( f \) is differentiable on \((-\infty, \infty)\) and \( f'(x) = -2x \)

(c) \( f \) is not differentiable at \( x = 0 \)

(d) \( f'(-x) = -f'(x) \)

(e) \( f \) is differentiable on \((-\infty, \infty)\) and \( f'(x) = 2|x| \)

14. If \( \sqrt{x} + \sqrt{y} = 4 \) defines implicitly a relation between \( x \) and \( y \), then \( y'' \) is equal to

(a) \(-\sqrt{\frac{y}{x}}\)

(b) \(-\sqrt{\frac{x}{y}}\)

(c) \(\frac{\sqrt{xy}}{2x^2y}(x + y)\)

(d) \(\frac{x\sqrt{y} + y\sqrt{x}}{2x^2}\)

(e) \(\frac{xy + y\sqrt{xy}}{2x^2y}\)
15. If \((x - y)^2 = x + y\), then

(a) \(\frac{dy}{dx} = \frac{2x - 2y + 1}{2x + 2y + 1}\)

(b) \(\frac{dy}{dx} = \frac{2x - 2y - 1}{2x + 2y + 1}\)

(c) \(\frac{dy}{dx} = \frac{2x - 2y - 1}{2x - 2y + 1}\)

(d) \(\frac{dy}{dx} = \frac{2x - 2y + 1}{2x - 2y - 1}\)

(e) \(\frac{dy}{dx} = 2x - 2y - 1\)
Name: ____________________________________________________________

ID: ________________ Sec: ________________

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1. The $x$-intercept of the tangent line to the curve $y = x\sqrt{x^2 - 8}$ at $x = -3$ is given by

(a) $x = -\frac{27}{10}$

(b) $x = 27$

(c) $x = -27$

(d) $x = \frac{27}{10}$

(e) $x = 10$

2. Suppose that $L$ is a function such that $L'(x) = \frac{1}{x}$ for $x > 0$.
Then the derivative of $F(x) = L(x^4) + L\left(\frac{1}{x}\right)$ is equal to

(a) $x^4 - x$

(b) $\frac{3}{x}$

(c) $\frac{4}{x^3}$

(d) $x^3$

(e) $\frac{5}{x}$
3. If $f(4) = \frac{1}{4}$, $f'(4) = -\frac{1}{4}$ and $g(x) = \frac{1 + xf(x)}{\sqrt{x}}$, then $g'(4) =$

(a) $\frac{5}{8}$

(b) $-\frac{1}{2}$

(c) 0

(d) $-\frac{5}{8}$

(e) $-1$

4. $\tanh(\ln x) =$

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

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

(c) $\infty$

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

(e) $\frac{1 - x^2}{x^2 + 1}$
5. If \( u = \sqrt{t^2} + 2\sqrt{t^3} \), then \( \frac{du}{dt} \) is equal to

(a) \( \frac{2 + 9\sqrt{t^5}}{3\sqrt{t}} \)
(b) \( \frac{9 + 4\sqrt{t^4}}{5\sqrt{t}} \)
(c) \( \frac{6 + 4\sqrt{t^4}}{6\sqrt{t}} \)
(d) \( \frac{2 + 3\sqrt{t}}{6\sqrt{t^3}} \)
(e) \( \frac{2 + 4\sqrt{t^5}}{5\sqrt{t^5}} \)

6. If \( y = \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \), then \( y' \) is equal to

(a) \( \frac{\sin^2 x \sec^8 x}{\cos^4 x(x^2 + 1)^2} \left[ \cot x + \frac{5 \sec x}{\sin x} - \frac{6x}{x^2 + 1} \right] \)
(b) \( \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \left[ 2 \sec x + \frac{4 \sec x}{\sin x} - \frac{8x}{x^2 + 1} \right] \)
(c) \( \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \left[ \cot x + \frac{8 \sec x}{\tan x} - \frac{3x}{x^2 + 1} \right] \)
(d) \( \frac{\sin^6 x}{\cos^4 x(x^2 + 1)^2} \left[ 2 \cot x + \frac{6 \cos x}{\cot x} - \frac{4x}{x^2 + 1} \right] \)
(e) \( \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \left[ 2 \cot x + \frac{4 \sec^2 x}{\tan x} - \frac{4x}{x^2 + 1} \right] \)
7. If \( y = \arctan(\arcsin \sqrt{x}) \), then \( \frac{dy}{dx} = \)

(a) \( \frac{1}{\sqrt{1 - x^2}[1 + (\arcsin \sqrt{x})^2]} \)
(b) \( \frac{1}{2\sqrt{x}\sqrt{1 - x}[1 + (\arcsin \sqrt{x})^2]} \)
(c) \( \frac{1}{1 + (\arcsin \sqrt{x})^2} \)
(d) \( \frac{1}{\sqrt{1 - x}[1 + (\arcsin \sqrt{x})^2]} \)
(e) \( \frac{1}{\sqrt{1 - x^2}[1 + \arcsin x]} \)

8. If \( g(x) = \sqrt{5 - 2x} \), then \( g'''(2) \) is equal to

(a) 2
(b) 1
(c) \( \frac{1}{2} \)
(d) -1
(e) -3
9. The values of $x$ for which the function $f(x) = x + 2\sin x$ has tangent lines parallel to the line $2x + 2y = 5$ are

(a) $(k + 1)\pi$, $k$ is an integer

(b) $2k\pi$, $k$ is an integer

(c) $k\pi$, $k$ is an integer

(d) none of the above

(e) $(2k + 1)\pi$, $k$ is an integer

10. $\lim_{x \to \pi/4} \frac{\sin x - \cos x}{\cos(2x)}$ is equal to

(a) $-\frac{\sqrt{2}}{2}$

(b) $\sqrt{2}$

(c) $-1$

(d) $1$

(e) $0$
11. There are two lines through the point $(2, -3)$ that are tangent to the parabola \( y = x^2 + x \). Then the sum of the slopes of these lines is

(a) 9
(b) 13.5
(c) 10
(d) 11
(e) 7.5

12. If \( \sqrt{x} + \sqrt{y} = 4 \) defines implicitly a relation between \( x \) and \( y \), then \( y'' \) is equal to

(a) \( \frac{\sqrt{xy}}{2x^2y}(x + y) \)
(b) \( -\frac{\sqrt{y}}{x} \)
(c) \( -\sqrt{\frac{x}{y}} \)
(d) \( \frac{x\sqrt{y} + y\sqrt{x}}{2x^2} \)
(e) \( \frac{xy + y\sqrt{xy}}{2x^2y} \)
13. An equation of the normal line to the graph of \( y = e^x \cos x \) when \( x = \frac{\pi}{2} \) is given by

(a) \( 2\pi \ln(\pi - 2)(y - 1) = x - \pi \)

(b) \( (\ln \sqrt{\pi} - \ln \sqrt{2})(y - 1) = 2x - \pi \)

(c) \( 2\pi(\ln \sqrt{\pi} - \ln \sqrt{2})(y - 1) = 2x - \pi \)

(d) \( \pi(\ln \sqrt{\pi} - \ln \sqrt{2})(y - \pi) = x - 1 \)

(e) \( \pi \ln \sqrt{\pi}(y - 1) = (\ln 2)x - \pi \)

14. Which one of the following statements is true about the function \( f(x) = x|x| \)?

(a) \( f'(-x) = -f'(x) \)

(b) \( f \) is differentiable on \((-\infty, \infty)\) and \( f'(x) = 2x \)

(c) \( f \) is differentiable on \((-\infty, \infty)\) and \( f'(x) = 2|x| \)

(d) \( f \) is not differentiable at \( x = 0 \)

(e) \( f \) is differentiable on \((-\infty, \infty)\) and \( f'(x) = -2x \)
15. If \((x - y)^2 = x + y\), then

(a) \[\frac{dy}{dx} = \frac{2x - 2y + 1}{2x - 2y - 1}\]

(b) \[\frac{dy}{dx} = \frac{2x - 2y - 1}{2x - 2y + 1}\]

(c) \[\frac{dy}{dx} = \frac{2x - 2y - 1}{2x + 2y + 1}\]

(d) \[\frac{dy}{dx} = \frac{2x - 2y + 1}{2x + 2y + 1}\]

(e) \[\frac{dy}{dx} = 2x - 2y - 1\]
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