Calculus

Chapter 3: Differentiation

Lesson 3: Trigonometric Derivatives and The Chain Rule

Question #1

Reference Q.301

$f(x) = 5 + 3\cos x$. What is $f'(x)$?

Question #2

Reference Q.302

$y = 4x^3 \sin x$. What is $\frac{dy}{dx}$?

Question #3

Reference Q.303

$f(x) = \frac{4\sin(x)}{1-\cos x}$ What is $f'(x)$?

Question #4

Reference Q.304

$y = 3\csc x - \cot x$. What is $\frac{dy}{dx}$?

Question #5

Reference Q.305

$f(x) = 2\sec x + \sqrt{x}\tan x$. What is $f'(x)$?

Question #6

Reference Q.306

$y = \frac{3\csc x}{3+\tan x}$. What is $\frac{dy}{dx}$?

Question #7

Reference Q.307

$f(x) = \csc x \cot x$. What is $f'(x)$?

Question #8

Reference Q.272

Find $\frac{dy}{dx}$ when $y = 2\left(3 - 4x^3\right)^2$?

Question #9

Reference Q.308

$f(x) = \cos^2(x) - \sin^2(x)$. What is $f'(x)$?

Question #10

Reference Q.309

Find $\frac{d^2y}{dx^2}$: $y = \cot(x)$

Question #11

Reference Q.310

Find the equation of the tangent line to the graph of $y = 2\cos x$ at $x = \frac{\pi}{2}$.

Question #12

Reference Q.311

A rocket is launched into the air from a platform which is 5 miles away from a crowd of people watching. If the height of the rocket is given by h, what is the rate of change of the height with respect to the angle, x. (i.e. calculate $\frac{dh}{dx}$)

Question #13

Reference Q.312

Try to determine the pattern followed by taking successive derivatives of the following trig function, and then calculate the actual derivative:

(a) $\frac{d^{1001}}{dx^{1001}}\cos x$

(b) $\frac{d^{1001}}{dx^{1001}}\sin x$

Question #14

Reference Q.313

Try to determine the pattern followed by taking successive derivatives of the following trig function, and then calculate the actual derivative:

$\frac{d^{1001}}{dx^{1001}}\cos x + e^{-x}$

Question #15

Reference Q.314

State the Chain Rule in Newtonian Form and in Leibniz Form.

Question #16

Reference Q.315

If $f(x) = x^2$ and $g(x) = 3x + 2$ find the derivative of $f(g(x))$

Question #17

Reference Q.316

If $f(x) = \sin(x)$ and $g(x) = -\frac{x}{4}$ find the derivative of $f(g(x))$

Question #18

Reference Q.317

Use the following table of values to find:

x	$a(x)$	$b(x)$	$a'(x)$	$b'(x)$
1	3	3	2	-2
3	1	-2	5	-1

a. a) $A'(1)$ where $A(x) = a(b(x))$

b. b) $B'(1)$ where $B(x) = b(a(x))$

Question #19

Reference Q.318

What is $f'(x)$ if $f(x) = (4x - 3)^8$?

Question #20

Reference Q.319

What is $f'(x)$ when $f(x) = \cos^3 x$?

Question #21

Reference Q.320

What is $f'(x)$ when $f(x) = \cos(x^3)$?

Question #22

Reference Q.321

What is $f'(x)$ when $f(x) = \sqrt{5 - x}$?

Question #23

Reference Q.322

What is $f'(x)$ when $f(x) = 2\csc^4 x^3$?

Question #24

Reference Q.323

What is $f'(x)$ when $f(x) = 2(\csc x^3)^4$

Question #25

Reference Q.324

What is $\frac{dy}{dx}$ when $y = \sin(\sin(x))$?

Question #26

Reference Q.325

Find $\frac{dy}{dx}$ when $y = x^2 \sec^2\left(\frac{x}{2}\right)$.

Question #27

Reference Q.326

Find the tangent to the graph of $y = \sin(x^2) + 2x$ at $x = \pi$.

Question #28

Reference Q.327

Find $\frac{dy}{d\theta}$ for the equation $y = (\tan(\pi - 2\theta))^4$.

Question #29

Reference Q.328

For the following table of values, find $h'(1)$:

a. $h(x) = f(x) + g(x)$

b. $h(x) = f(g(x))$

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
1	2	3	4	5
3	6	7	8	9

Question #30

Reference Q.329

Using the following table, find $h'(2)$, where

(a) $h(x) = \frac{f(x)}{g(x)}$

(b) $h(x) = g(f^2(x))$

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
2	3	5	7	9
9	11	13	15	17

Question #31

Reference Q.330

Prove that the derivative of $\cos x = -\sin x$.

Question #32

Reference Q.331

Find a formula for $\frac{d}{dx}u\left(v\left(w(x)\right)\right)$

Question #33

Reference Q.9137

Let

$f(x) = g(x)\cos\left(h(x)\right),\ g(x) = 1 + \frac{1}{x},\ h(x) = \sqrt{p(x)},\ p(x) = x^3$

. Find $f'(x)$.

Question #34

Reference Q.9162

Find $\frac{dy^2}{d^2x}$ if $y = \cos\left(ax + b\right)$.

Question #35

Reference Q.9163

Find $\frac{dy}{dx}$ if $y = \sin^2\left(x^2 + 2\right)$