VCE Mathematics Methods: Practice problems and solutions: Functions and Calculus

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Motivation
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1. Introduction

1.1 Motivation

My year 9 daughter kept asking me to write her new math problems, apart from those in the text book, so she can do more practice. I'd take a piece of paper and write problems, but it's a tedious process. So I thought: how about I **generate tons** of them?

1.2 Problem generation method

The problems and solutions have all been generated using the python programming language, and relied on a number of open source python packages, especially the SymPy package. Therefore, you can trust the accuracy of the solutions.

1.3 Structure

This document includes hundreds of mathematics problems that have been designed for year 11 students enrolled in VCE Mathematics Methods.

Most of the problems require the student to perform a single task, such as calculating the derivative of a function or finding the prime numbers within a range of integers. In addition, a number of questions have been designed based on the Mathematics Methods exam questions, which require the student to perform two or more tasks.

I hope you find them useful.

Problems
Solutions

2. Functions

2.1 Problems

Exercise 2.1 For the following two functions,

$$f(x) = -6ax^2 - 2ax - 8$$

and

$$g(x) = 3ax + 2$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.2 If $f(x)$ is defined as

$$f(x) = x - 4$$

and $g(x)$ is defined as

$$g(x) = 2x^2 - 5x + 7$$

simplify $g(f(x))$.

Exercise 2.3 For the following two functions,

$$f(x) = a\left(-8x^2 + 4x + 9\right)$$

and

$$g(x) = 7ax^2 - 8ax - 1$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.4 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = -8a - 10x$$

and

$$g(x) = 6a + 8x$$

Exercise 2.5 For the following two functions,

$$f(x) = ax^2 - 9ax + 5$$

and

$$g(x) = -9ax^2 + 9ax + 9$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.6 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = -4x - 3$$

and

$$g(x) = 3a - 7x$$

Exercise 2.7 For the following two functions,

$$f(x) = ax^2 - 9ax + 9$$

and

$$g(x) = -3ax + 1$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.8 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = -2ax^2 - 10a + 5x$$

and

$$g(x) = 6ax - 9$$

Exercise 2.9 If $f(x)$ is defined as

$$f(x) = -x - 1$$

and $g(x)$ is defined as

$$g(x) = 5x^2 + 8x + 3$$

simplify $g(f(x))$.

Exercise 2.10 If $f(x)$ is defined as

$$f(x) = \frac{-3x - 8}{3x + 6}$$

find $f^{-1}(x)$.

Exercise 2.11 For the following two functions,

$$f(x) = -10ax^2 - 3ax + 7$$

and

$$g(x) = a\left(4x^2 + 7x - 10\right)$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.12 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = 2x + 1$$

and

$$g(x) = -9a - 10x$$

Exercise 2.13 For the following two functions,

$$f(x) = a\left(5x^2 + 2x - 3\right)$$

and

$$g(x) = ax^2 - 4ax - 9$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.14 If $f(x)$ is defined as

$$f(x) = -6x - 8$$

and $g(x)$ is defined as

$$g(x) = -6x^2 + 5x + 4$$

simplify $g(f(x))$.

Exercise 2.15 If $f(x)$ is defined as

$$f(x) = \frac{-7ax - 7a}{3a - 10x}$$

find the value of a if $f^{-1}(1) = 10$.

Exercise 2.16 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = 3ax^2 - 3a - x$$

and

$$g(x) = -9ax - 1$$

Exercise 2.17 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = -x - 6$$

and

$$g(x) = 3a - 10x$$

Exercise 2.18 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = 2 - 2x$$

and

$$g(x) = 6a - 7x$$

Exercise 2.19 If $f(x)$ is defined as

$$f(x) = \frac{2ax+5a}{-4a+10x}$$

find the value of a if $f^{-1}(3) = 10$.

Exercise 2.20 For the following two functions,

$$f(x) = -3ax^2 - 2ax - 6$$

and

$$g(x) = 5ax^2 + 9ax + 9$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.21 If $f(x)$ is defined as

$$f(x) = \frac{-3ax-2a}{6a+8x}$$

find the value of a if $f^{-1}(10) = 1$.

Exercise 2.22 For the following two functions,

$$f(x) = 7ax^2 - 6ax - 8$$

and

$$g(x) = 10ax^2 + 6ax + 6$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.23 For the following two functions,

$$f(x) = -4ax^2 + 5ax - 6$$

and

$$g(x) = -2ax - 8$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.24 If $f(x)$ is defined as

$$f(x) = 2ax + 5x^2$$

and $g(x)$ is defined as

$$g(x) = -9x - 2$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.25 If $f(x)$ is defined as

$$f(x) = ax - 7x^2$$

and $g(x)$ is defined as

$$g(x) = -8x - 6$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.26 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = 10ax^2 - 9a + x$$

and

$$g(x) = -2ax - 6$$

Exercise 2.27 If $f(x)$ is defined as

$$f(x) = \frac{-6x - 6}{9x + 5}$$

what is the domain and range of $f(x)$?

Exercise 2.28 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = -9ax^2 - 9a - 9x$$

and

$$g(x) = -8ax - 4$$

Exercise 2.29 If $f(x)$ is defined as

$$f(x) = \frac{-9ax - a}{-2a - 7x}$$

find the value of a if $f^{-1}(3) = 3$.

Exercise 2.30 If $f(x)$ is defined as

$$f(x) = \frac{-7ax + a}{-9a - 7x}$$

find the value of a if $f^{-1}(7) = 7$.

Exercise 2.31 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = 3ax^2 + 6a + 4x$$

and

$$g(x) = a\,(9 - x)$$

Exercise 2.32 If $f(x)$ is defined as

$$f(x) = \frac{-x - 7}{9x - 6}$$

what is the domain and range of $f(x)$?

Exercise 2.33 If $f(x)$ is defined as

$$f(x) = \frac{-3ax + 2a}{-9a - 3x}$$

find the value of a if $f^{-1}(10) = 6$.

Exercise 2.34 If $f(x)$ is defined as

$$f(x) = \frac{2-4x}{7x+3}$$

find $f^{-1}(x)$.

Exercise 2.35 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = -8a - 3x$$

and

$$g(x) = -6a + 6x$$

Exercise 2.36 If $f(x)$ is defined as

$$f(x) = \frac{-3x-5}{9-10x}$$

find $f^{-1}(x)$.

Exercise 2.37 If $f(x)$ is defined as

$$f(x) = -4ax - 5x^2$$

and $g(x)$ is defined as

$$g(x) = x - 5$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.38 If $f(x)$ is defined as

$$f(x) = \frac{-3x-1}{3-4x}$$

what is the domain and range of $f(x)$?

Exercise 2.39 If $f(x)$ is defined as

$$f(x) = \frac{7x-8}{-10x-10}$$

what is the domain and range of $f(x)$?

Exercise 2.40 If $f(x)$ is defined as

$$f(x) = \frac{8x+1}{10-9x}$$

what is the domain and range of $f(x)$?

Exercise 2.41 If $f(x)$ is defined as

$$f(x) = \frac{-2ax+6a}{6a+6x}$$

find the value of a if $f^{-1}(4) = 8$.

Exercise 2.42 For the following two functions,

$$f(x) = a\left(-6x^2 - 2x + 5\right)$$

and

$$g(x) = 2ax^2 - 6ax - 2$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.43 If $f(x)$ is defined as

$$f(x) = \frac{10ax + 8a}{-10a - 6x}$$

find the value of a if $f^{-1}(3) = 10$.

Exercise 2.44 If $f(x)$ is defined as

$$f(x) = \frac{x + 8}{-8x - 8}$$

what is the domain and range of $f(x)$?

Exercise 2.45 For the following two functions,

$$f(x) = 10ax^2 + 7ax - 9$$

and

$$g(x) = a\left(3x^2 + 9x + 5\right)$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.46 If $f(x)$ is defined as

$$f(x) = 2x + 7$$

and $g(x)$ is defined as

$$g(x) = -5x^2 - 7x + 3$$

simplify $g(f(x))$.

Exercise 2.47 If $f(x)$ is defined as

$$f(x) = \frac{1 - 10x}{1 - 4x}$$

find $f^{-1}(x)$.

Exercise 2.48 If $f(x)$ is defined as

$$f(x) = 9 - x$$

and $g(x)$ is defined as

$$g(x) = 4x^2 - 7x - 4$$

simplify $g(f(x))$.

Exercise 2.49 For the following two functions,

$$f(x) = a\left(-5x^2 - 10x - 7\right)$$

and

$$g(x) = 8ax + 9$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.50 If $f(x)$ is defined as

$$f(x) = \frac{-10x - 8}{3x - 8}$$

what is the domain and range of $f(x)$?

Exercise 2.51 If $f(x)$ is defined as

$$f(x) = \frac{-ax - 9a}{7a - 5x}$$

find the value of a if $f^{-1}(6) = 5$.

Exercise 2.52 If $f(x)$ is defined as

$$f(x) = -x - 9$$

and $g(x)$ is defined as

$$g(x) = 6x^2 - 3x + 2$$

simplify $g(f(x))$.

Exercise 2.53 If $f(x)$ is defined as

$$f(x) = -6ax - x^2$$

and $g(x)$ is defined as

$$g(x) = 9 - 9x$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.54 If $f(x)$ is defined as

$$f(x) = \frac{6x + 4}{-10x - 7}$$

what is the domain and range of $f(x)$?

Exercise 2.55 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = 5a - 8x$$

and

$$g(x) = -4a - 10x$$

Exercise 2.56 For the following two functions,

$$f(x) = -9ax^2 - ax - 5$$

and

$$g(x) = a(-6x - 7)$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.57 For the following two functions,

$$f(x) = 4ax^2 + 9ax - 5$$

and

$$g(x) = 3ax^2 + 6ax + 5$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.58 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = 2x + 7$$

and

$$g(x) = -8a - 3x$$

Exercise 2.59 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = 6 - 6x$$

and

$$g(x) = 4a + 7x$$

Exercise 2.60 If $f(x)$ is defined as

$$f(x) = \frac{x+3}{3-3x}$$

find $f^{-1}(x)$.

Exercise 2.61 If $f(x)$ is defined as

$$f(x) = \frac{10-3x}{5x+4}$$

find $f^{-1}(x)$.

Exercise 2.62 If $f(x)$ is defined as

$$f(x) = \frac{3-10x}{7x+2}$$

what is the domain and range of $f(x)$?

Exercise 2.63 If $f(x)$ is defined as

$$f(x) = \frac{6ax-8a}{-3a-6x}$$

find the value of a if $f^{-1}(9) = 7$.

Exercise 2.64 If $f(x)$ is defined as

$$f(x) = -ax + 6x^2$$

and $g(x)$ is defined as

$$g(x) = x + 9$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.65 If $f(x)$ is defined as

$$f(x) = 4x - 1$$

and $g(x)$ is defined as

$$g(x) = -2x^2 + 3x - 2$$

simplify $g(f(x))$.

Exercise 2.66 For the following two functions,

$$f(x) = 7ax^2 - 6ax + 10$$

and

$$g(x) = a\left(5x^2 + 6x + 10\right)$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.67 For the following two functions,

$$f(x) = 2ax^2 + 5ax + 2$$

and

$$g(x) = -4ax^2 + ax - 4$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.68 If $f(x)$ is defined as

$$f(x) = \frac{7x - 5}{-2x - 3}$$

what is the domain and range of $f(x)$?

Exercise 2.69 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = -5ax^2 - 10a - 10x$$

and

$$g(x) = 2ax - 7$$

Exercise 2.70 If $f(x)$ is defined as

$$f(x) = -5x - 5$$

and $g(x)$ is defined as

$$g(x) = 10x^2 - 6x + 1$$

simplify $g(f(x))$.

Exercise 2.71 If $f(x)$ is defined as

$$f(x) = \frac{9 - 7x}{3 - 2x}$$

what is the domain and range of $f(x)$?

Exercise 2.72 If $f(x)$ is defined as

$$f(x) = \frac{6ax - a}{-8a - 6x}$$

find the value of a if $f^{-1}(3) = 8$.

Exercise 2.73 If $f(x)$ is defined as

$$f(x) = \frac{3x - 9}{4x - 10}$$

find $f^{-1}(x)$.

Exercise 2.74 For the following two functions,

$$f(x) = -3ax^2 + 6ax - 4$$

and

$$g(x) = 6ax^2 - 5ax + 6$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.75 If $f(x)$ is defined as

$$f(x) = \frac{-8x - 6}{6 - 9x}$$

find $f^{-1}(x)$.

Exercise 2.76 If $f(x)$ is defined as

$$f(x) = \frac{9x - 9}{8x + 8}$$

what is the domain and range of $f(x)$?

Exercise 2.77 If $f(x)$ is defined as

$$f(x) = 2x - 3$$

and $g(x)$ is defined as

$$g(x) = 8x^2 - 3x + 4$$

simplify $g(f(x))$.

Exercise 2.78 If $f(x)$ is defined as

$$f(x) = \frac{7x-3}{8x+3}$$

find $f^{-1}(x)$.

Exercise 2.79 For the following two functions,

$$f(x) = 10ax^2 - 4ax + 5$$

and

$$g(x) = -10ax^2 + 4ax - 8$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.80 For the following two functions,

$$f(x) = ax^2 + 9ax + 5$$

and

$$g(x) = -9ax^2 - 6ax + 2$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.81 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = -9ax^2 - 4a + 5x$$

and

$$g(x) = a(8x+9)$$

Exercise 2.82 For the following two functions,

$$f(x) = a\left(-x^2 - 7x - 8\right)$$

and

$$g(x) = ax + 3$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.83 If $f(x)$ is defined as

$$f(x) = x + 6$$

and $g(x)$ is defined as

$$g(x) = -4x^2 + 6x + 7$$

simplify $g(f(x))$.

Exercise 2.84 For the following two functions,

$$f(x) = -8ax^2 - 6ax + 2$$

and

$$g(x) = 3a(3x+2)$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.85 If $f(x)$ is defined as

$$f(x) = \frac{-4ax+6a}{-8a-x}$$

find the value of a if $f^{-1}(2) = 4$.

Exercise 2.86 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = 3ax^2 - 10a + x$$

and

$$g(x) = 10ax - 7$$

Exercise 2.87 If $f(x)$ is defined as

$$f(x) = \frac{3ax-5a}{-3a-7x}$$

find the value of a if $f^{-1}(6) = 3$.

Exercise 2.88 If $f(x)$ is defined as

$$f(x) = \frac{10x+6}{4-4x}$$

what is the domain and range of $f(x)$?

Exercise 2.89 If $f(x)$ is defined as

$$f(x) = \frac{8ax+9a}{-7a-3x}$$

find the value of a if $f^{-1}(6) = 4$.

Exercise 2.90 If $f(x)$ is defined as

$$f(x) = \frac{8x+1}{10x+5}$$

what is the domain and range of $f(x)$?

Exercise 2.91 If $f(x)$ is defined as

$$f(x) = \frac{-6x-9}{-9x-9}$$

what is the domain and range of $f(x)$?

Exercise 2.92 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = 8x + 4$$

and

$$g(x) = 6a + 8x$$

Exercise 2.93 If $f(x)$ is defined as

$$f(x) = \frac{-ax-10a}{7a-5x}$$

find the value of a if $f^{-1}(1) = 2$.

Exercise 2.94 If $f(x)$ is defined as

$$f(x) = \frac{6-x}{4x+4}$$

what is the domain and range of $f(x)$?

Exercise 2.95 For the following two functions,

$$f(x) = -9ax^2 - 7ax + 2$$

and

$$g(x) = 8ax - 8$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.96 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = -8a + 5x$$

and

$$g(x) = -5a + 5x$$

Exercise 2.97 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = 2x + 2$$

and

$$g(x) = 6a - 3x$$

Exercise 2.98 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = x + 2$$

and

$$g(x) = 7a + 4x$$

Exercise 2.99 If $f(x)$ is defined as

$$f(x) = \frac{6ax + 5a}{-7a + 7x}$$

find the value of a if $f^{-1}(1) = 7$.

Exercise 2.100 For the following two functions,

$$f(x) = -7ax^2 + 8ax - 2$$

and

$$g(x) = 5ax^2 - 4ax + 1$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.101 If $f(x)$ is defined as

$$f(x) = 6 - 2x$$

and $g(x)$ is defined as

$$g(x) = -x^2 - 4x + 3$$

simplify $g(f(x))$.

Exercise 2.102 If $f(x)$ is defined as

$$f(x) = 8x + 7$$

and $g(x)$ is defined as

$$g(x) = -4x^2 - 2x + 8$$

simplify $g(f(x))$.

Exercise 2.103 If $f(x)$ is defined as

$$f(x) = -5ax - 10x^2$$

and $g(x)$ is defined as

$$g(x) = -5x - 4$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.104 If $f(x)$ is defined as

$$f(x) = 4ax + 3x^2$$

and $g(x)$ is defined as

$$g(x) = -10x - 2$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.105 If $f(x)$ is defined as

$$f(x) = -6x - 9$$

and $g(x)$ is defined as

$$g(x) = 3x^2 - 9x + 4$$

simplify $g(f(x))$.

Exercise 2.106 For the following two functions,

$$f(x) = 4ax^2 + 3ax + 1$$

and

$$g(x) = 2ax - 4$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.107 If $f(x)$ is defined as

$$f(x) = 5x - 10$$

and $g(x)$ is defined as

$$g(x) = 2x^2 - 9x - 7$$

simplify $g(f(x))$.

Exercise 2.108 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = -6x - 3$$

and

$$g(x) = 4a + 3x$$

Exercise 2.109 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = 2a + 2x$$

and

$$g(x) = 5a - 5x$$

Exercise 2.110 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = -5ax^2 - 6a - 4x$$

and

$$g(x) = -8ax - 7$$

Exercise 2.111 If $f(x)$ is defined as

$$f(x) = \frac{2x+7}{9-10x}$$

what is the domain and range of $f(x)$?

Exercise 2.112 If $f(x)$ is defined as

$$f(x) = 4 - 9x$$

and $g(x)$ is defined as

$$g(x) = 2x^2 + 3x + 8$$

simplify $g(f(x))$.

Exercise 2.113 If $f(x)$ is defined as

$$f(x) = \frac{4-10x}{3x+4}$$

what is the domain and range of $f(x)$?

Exercise 2.114 For the following two functions,

$$f(x) = a\left(8x^2 + 5x - 4\right)$$

and

$$g(x) = 7ax^2 - 9ax + 10$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.115 If $f(x)$ is defined as

$$f(x) = \frac{9ax + 2a}{-2a + 9x}$$

find the value of a if $f^{-1}(1) = 2$.

Exercise 2.116 If $f(x)$ is defined as

$$f(x) = 2x + 10$$

and $g(x)$ is defined as

$$g(x) = 6x^2 + 9x - 4$$

simplify $g(f(x))$.

Exercise 2.117 If $f(x)$ is defined as

$$f(x) = \frac{5x + 8}{-7x - 3}$$

find $f^{-1}(x)$.

Exercise 2.118 For the following two functions,

$$f(x) = a\left(-2x^2 + 5x + 4\right)$$

and

$$g(x) = ax^2 + 9ax + 8$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.119 If $f(x)$ is defined as

$$f(x) = 10 - 6x$$

and $g(x)$ is defined as

$$g(x) = 9x^2 - 10x - 10$$

simplify $g(f(x))$.

Exercise 2.120 If $f(x)$ is defined as

$$f(x) = ax - 10x^2$$

and $g(x)$ is defined as

$$g(x) = -8x - 1$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.121 If $f(x)$ is defined as

$$f(x) = \frac{9x+5}{-x-5}$$

find $f^{-1}(x)$.

Exercise 2.122 If $f(x)$ is defined as

$$f(x) = \frac{7-5x}{4-x}$$

what is the domain and range of $f(x)$?

Exercise 2.123 If $f(x)$ is defined as

$$f(x) = -5ax - 7x^2$$

and $g(x)$ is defined as

$$g(x) = 9x - 1$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.124 If $f(x)$ is defined as

$$f(x) = \frac{-ax+2a}{-4a+7x}$$

find the value of a if $f^{-1}(1) = 9$.

Exercise 2.125 If $f(x)$ is defined as

$$f(x) = 9 - 8x$$

and $g(x)$ is defined as

$$g(x) = 4x^2 - 10x - 3$$

simplify $g(f(x))$.

Exercise 2.126 If $f(x)$ is defined as

$$f(x) = -4ax + 10x^2$$

and $g(x)$ is defined as

$$g(x) = -6x - 8$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.127 If $f(x)$ is defined as

$$f(x) = \frac{9-6x}{x-8}$$

find $f^{-1}(x)$.

Exercise 2.128 If $f(x)$ is defined as

$$f(x) = \frac{4x+4}{-10x-8}$$

what is the domain and range of $f(x)$?

Exercise 2.129 If $f(x)$ is defined as

$$f(x) = 3x+6$$

and $g(x)$ is defined as

$$g(x) = -2x^2+4x+7$$

simplify $g(f(x))$.

Exercise 2.130 If $f(x)$ is defined as

$$f(x) = 10ax+8x^2$$

and $g(x)$ is defined as

$$g(x) = -9x-4$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.131 If $f(x)$ is defined as

$$f(x) = -3x-10$$

and $g(x)$ is defined as

$$g(x) = 6x^2-9x-9$$

simplify $g(f(x))$.

Exercise 2.132 If $f(x)$ is defined as

$$f(x) = -x-10$$

and $g(x)$ is defined as

$$g(x) = 4x^2+10x+2$$

simplify $g(f(x))$.

Exercise 2.133 If $f(x)$ is defined as

$$f(x) = \frac{x-5}{8-7x}$$

find $f^{-1}(x)$.

Exercise 2.134 If $f(x)$ is defined as

$$f(x) = 2ax-2x^2$$

and $g(x)$ is defined as

$$g(x) = 4x+9$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.135 For the following two functions,

$$f(x) = 4ax^2 - 10ax - 3$$

and

$$g(x) = a\left(-4x^2 - x + 2\right)$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.136 If $f(x)$ is defined as

$$f(x) = 8ax + x^2$$

and $g(x)$ is defined as

$$g(x) = 9x - 4$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.137 If $f(x)$ is defined as

$$f(x) = \frac{6ax + 6a}{5a - 2x}$$

find the value of a if $f^{-1}(9) = 2$.

Exercise 2.138 If $f(x)$ is defined as

$$f(x) = \frac{10 - 8x}{9x - 2}$$

what is the domain and range of $f(x)$?

Exercise 2.139 If $f(x)$ is defined as

$$f(x) = \frac{7x + 4}{3 - 6x}$$

find $f^{-1}(x)$.

Exercise 2.140 If $f(x)$ is defined as

$$f(x) = -3ax + 2x^2$$

and $g(x)$ is defined as

$$g(x) = -10x - 9$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.141 For the following two functions,

$$f(x) = -6ax^2 - 3ax + 3$$

and

$$g(x) = a\left(5x^2 + 3x - 1\right)$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.142 If $f(x)$ is defined as

$$f(x) = -7x - 2$$

and $g(x)$ is defined as

$$g(x) = -2x^2 - 3x + 5$$

simplify $g(f(x))$.

Exercise 2.143 If $f(x)$ is defined as

$$f(x) = \frac{5 - 4x}{-8x - 4}$$

find $f^{-1}(x)$.

Exercise 2.144 If $f(x)$ is defined as

$$f(x) = 9ax + 4x^2$$

and $g(x)$ is defined as

$$g(x) = -8x - 10$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.145 If $f(x)$ is defined as

$$f(x) = \frac{2x + 5}{2x + 8}$$

what is the domain and range of $f(x)$?

Exercise 2.146 For the following two functions,

$$f(x) = -6ax^2 + 9ax - 9$$

and

$$g(x) = a(-5x - 2)$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.147 If $f(x)$ is defined as

$$f(x) = \frac{9ax + 4a}{-6a + 9x}$$

find the value of a if $f^{-1}(5) = 9$.

Exercise 2.148 If $f(x)$ is defined as

$$f(x) = \frac{5ax - a}{-9a + 6x}$$

find the value of a if $f^{-1}(6) = 6$.

Exercise 2.149 If $f(x)$ is defined as

$$f(x) = \frac{-9ax - 5a}{7a - 2x}$$

find the value of a if $f^{-1}(1) = 1$.

Exercise 2.150 If $f(x)$ is defined as

$$f(x) = 5 - 3x$$

and $g(x)$ is defined as

$$g(x) = -7x^2 + 5x - 8$$

simplify $g(f(x))$.

Exercise 2.151 For the following two functions,

$$f(x) = 9ax^2 + 8ax + 9$$

and

$$g(x) = -ax - 5$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.152 If $f(x)$ is defined as

$$f(x) = 2x + 3$$

and $g(x)$ is defined as

$$g(x) = -9x^2 - 10x + 6$$

simplify $g(f(x))$.

Exercise 2.153 For the following two functions,

$$f(x) = a\left(-x^2 - 10x - 8\right)$$

and

$$g(x) = -2ax - 7$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.154 For the following two functions,

$$f(x) = a\left(-2x^2 - 9x + 6\right)$$

and

$$g(x) = ax + 7$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.155 If $f(x)$ is defined as

$$f(x) = 7x + 9$$

and $g(x)$ is defined as

$$g(x) = 6x^2 - 2x - 9$$

simplify $g(f(x))$.

Exercise 2.156 If $f(x)$ is defined as

$$f(x) = 3ax - 7x^2$$

and $g(x)$ is defined as

$$g(x) = -5x - 4$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.157 For the following two functions,

$$f(x) = -6ax^2 - 3ax + 8$$

and

$$g(x) = 2a\left(5x^2 + 4x - 2\right)$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.158 If $f(x)$ is defined as

$$f(x) = \frac{-10ax - 6a}{-7a - 6x}$$

find the value of a if $f^{-1}(2) = 6$.

Exercise 2.159 If $f(x)$ is defined as

$$f(x) = \frac{-8ax - 10a}{a + 4x}$$

find the value of a if $f^{-1}(2) = 2$.

Exercise 2.160 If $f(x)$ is defined as

$$f(x) = \frac{-7ax - 9a}{a - x}$$

find the value of a if $f^{-1}(6) = 7$.

Exercise 2.161 For the following two functions,

$$f(x) = a\left(2x^2 + 10x - 9\right)$$

and

$$g(x) = -ax + 4$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.162 If $f(x)$ is defined as

$$f(x) = -7x - 6$$

and $g(x)$ is defined as

$$g(x) = -7x^2 - x + 3$$

simplify $g(f(x))$.

Exercise 2.163 For the following two functions,

$$f(x) = 6ax^2 - 2ax - 1$$

and

$$g(x) = -ax - 2$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.164 If $f(x)$ is defined as

$$f(x) = \frac{4x+8}{9x+9}$$

find $f^{-1}(x)$.

Exercise 2.165 For the following two functions,

$$f(x) = -4ax^2 + 10ax + 7$$

and

$$g(x) = a(7-x)$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.166 If $f(x)$ is defined as

$$f(x) = 1 - 3x$$

and $g(x)$ is defined as

$$g(x) = 9x^2 - 5x + 7$$

simplify $g(f(x))$.

Exercise 2.167 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = -8ax^2 + 7a + 5x$$

and

$$g(x) = -6ax + 9$$

Exercise 2.168 If $f(x)$ is defined as

$$f(x) = \frac{4-5x}{x-3}$$

what is the domain and range of $f(x)$?

Exercise 2.169 If $f(x)$ is defined as

$$f(x) = \frac{8ax+2a}{3a-2x}$$

find the value of a if $f^{-1}(7) = 7$.

Exercise 2.170 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = ax^2 - a + 8x$$

and

$$g(x) = -3ax - 10$$

Exercise 2.171 For the following two functions,

$$f(x) = a\left(4x^2 - 10x - 5\right)$$

and

$$g(x) = 2ax^2 - 7ax + 8$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.172 For the following two functions,

$$f(x) = a\left(-7x^2 - 6x + 10\right)$$

and

$$g(x) = -2ax + 1$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.173 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = 5x + 5$$

and

$$g(x) = 5a + 10x$$

Exercise 2.174 If $f(x)$ is defined as

$$f(x) = -ax + 3x^2$$

and $g(x)$ is defined as

$$g(x) = 7x + 2$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.175 If $f(x)$ is defined as

$$f(x) = \frac{7x + 5}{2 - 3x}$$

find $f^{-1}(x)$.

Exercise 2.176 If $f(x)$ is defined as

$$f(x) = \frac{9 - 9x}{9x - 3}$$

what is the domain and range of $f(x)$?

Exercise 2.177 For the following two functions,

$$f(x) = -ax^2 - 2ax + 2$$

and

$$g(x) = 7ax^2 + 8ax + 9$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.178 If $f(x)$ is defined as

$$f(x) = 3x + 1$$

and $g(x)$ is defined as

$$g(x) = 6x^2 + x + 9$$

simplify $g(f(x))$.

Exercise 2.179 If $f(x)$ is defined as

$$f(x) = 3ax - 6x^2$$

and $g(x)$ is defined as

$$g(x) = 7x + 5$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.180 If $f(x)$ is defined as

$$f(x) = -7ax + 9x^2$$

and $g(x)$ is defined as

$$g(x) = 6 - 2x$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.181 For the following two functions,

$$f(x) = a\left(-10x^2 - 2x + 7\right)$$

and

$$g(x) = 5ax - 4$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.182 If $f(x)$ is defined as

$$f(x) = \frac{5x + 9}{4 - 5x}$$

what is the domain and range of $f(x)$?

Exercise 2.183 For the following two functions,

$$f(x) = 6ax^2 - 3ax + 1$$

and

$$g(x) = 3a(x+3)$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.184 If $f(x)$ is defined as

$$f(x) = \frac{8-6x}{3x-3}$$

what is the domain and range of $f(x)$?

Exercise 2.185 For the following two functions,

$$f(x) = a\left(-9x^2 + 5x + 2\right)$$

and

$$g(x) = -5ax - 5$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.186 If $f(x)$ is defined as

$$f(x) = 6x - 7$$

and $g(x)$ is defined as

$$g(x) = -10x^2 + 9x - 10$$

simplify $g(f(x))$.

Exercise 2.187 If $f(x)$ is defined as

$$f(x) = \frac{ax+8a}{-9a+x}$$

find the value of a if $f^{-1}(6) = 10$.

Exercise 2.188 For the following two functions,

$$f(x) = -8ax^2 - 3ax + 2$$

and

$$g(x) = -2ax^2 - 8ax - 9$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.189 If $f(x)$ is defined as

$$f(x) = \frac{-ax-a}{-2a+9x}$$

find the value of a if $f^{-1}(5) = 1$.

Exercise 2.190 If $f(x)$ is defined as

$$f(x) = 2ax - 9x^2$$

and $g(x)$ is defined as

$$g(x) = 3x + 1$$

solve the equation

$$g(f(x)) = 0$$

Exercise 2.191 If $f(x)$ is defined as

$$f(x) = \frac{9ax + 3a}{-5a + x}$$

find the value of a if $f^{-1}(2) = 6$.

Exercise 2.192 For the following two functions,

$$f(x) = 5ax^2 - 6ax - 7$$

and

$$g(x) = ax^2 + 5ax - 4$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.193 For the following two functions,

$$f(x) = 5ax^2 + 5ax - 1$$

and

$$g(x) = 10ax^2 + 3ax - 9$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.194 If $f(x)$ is defined as

$$f(x) = \frac{-2x - 5}{7 - 3x}$$

find $f^{-1}(x)$.

Exercise 2.195 For the following two functions,

$$f(x) = a\left(-7x^2 - x + 5\right)$$

and

$$g(x) = -6ax - 9$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.196 For the following two functions,

$$f(x) = 2a\left(-5x^2 - x + 1\right)$$

and

$$g(x) = 4ax + 10$$

what values of a will ensure that the graphs of these functions never intersect?

Exercise 2.197 If $f(x)$ is defined as

$$f(x) = \frac{10x+6}{5x+5}$$

find $f^{-1}(x)$.

Exercise 2.198 Find the value of x at which the graphs of the following functions intersect:

$$f(x) = -8ax^2 + 9a - 4x$$

and

$$g(x) = -3ax - 8$$

Exercise 2.199 If $f(x)$ is defined as

$$f(x) = \frac{10x+7}{7x+7}$$

what is the domain and range of $f(x)$?

Exercise 2.200 For the following two functions,

$$f(x) = -3ax^2 + 2ax - 7$$

and

$$g(x) = a\left(-x^2 + 7x - 5\right)$$

what values of a will ensure that the graphs of these functions never intersect?

2.2 Solutions

1. $$0 < a, a < \frac{48}{5}$$

2. $$2x^2 - 21x + 59$$

3. $$-\frac{5}{57} < a, a < 0$$

4. $$\left\{-\frac{7a}{9}\right\}$$

5. $$-\frac{40}{81} < a, a < 0$$

6. $$\{a+1\}$$

7.

$$0 < a, a < \frac{8}{9}$$

8.

$$\left\{ -\frac{6a-5}{4a} - \frac{\sqrt{-44a^2+12a+25}}{4a}, -\frac{6a-5}{4a} + \frac{\sqrt{-44a^2+12a+25}}{4a} \right\}$$

9.

$$5x^2 + 2x$$

10.

$$\left\{ -\frac{2 \cdot (3y+4)}{3\,(y+1)} \right\}$$

11.

$$-\frac{98}{165} < a, a < 0$$

12.

$$\left\{ -\frac{3a}{4} - \frac{1}{12} \right\}$$

13.

$$0 < a, a < \frac{12}{7}$$

14.

$$-216x^2 - 606x - 420$$

15.

1.25

16.

$$\left\{ -\frac{9a-1}{6a} - \frac{\sqrt{117a^2-30a+1}}{6a}, -\frac{9a-1}{6a} + \frac{\sqrt{117a^2-30a+1}}{6a} \right\}$$

17.

$$\left\{ \frac{a}{3} + \frac{2}{3} \right\}$$

18.

$$\left\{ \frac{6a}{5} - \frac{2}{5} \right\}$$

19.

8.108

20.

$$0 < a, a < \frac{480}{121}$$

21.

$$-1.231$$

22.

$$0 < a, a < \frac{7}{6}$$

23.

$$-\frac{32}{49} < a, a < 0$$

24.

$$\left\{-\frac{a}{5} - \frac{\sqrt{9a^2-10}}{15}, -\frac{a}{5} + \frac{\sqrt{9a^2-10}}{15}\right\}$$

25.

$$\left\{\frac{a}{14} - \frac{\sqrt{a^2+21}}{14}, \frac{a}{14} + \frac{\sqrt{a^2+21}}{14}\right\}$$

26.

$$\left\{-\frac{2a+1}{20a} - \frac{\sqrt{364a^2-236a+1}}{20a}, -\frac{2a+1}{20a} + \frac{\sqrt{364a^2-236a+1}}{20a}\right\}$$

27. Domain:

$$\left(-\infty, -\frac{5}{9}\right) \cup \left(-\frac{5}{9}, \infty\right)$$

Range:

$$\left(-\infty, -\frac{2}{3}\right) \cup \left(-\frac{2}{3}, \infty\right)$$

28.

$$\left\{-\frac{\sqrt{81-260a^2}}{18a} + \frac{8a-9}{18a}, \frac{\sqrt{81-260a^2}}{18a} + \frac{8a-9}{18a}\right\}$$

29.

$$2.864$$

30.

$$-22.867$$

31.

$$\left\{-\frac{a+4}{6a}-\frac{\sqrt{37a^2+8a+16}}{6a},-\frac{a+4}{6a}+\frac{\sqrt{37a^2+8a+16}}{6a}\right\}$$

32. Domain:

$$\left(-\infty,\frac{2}{3}\right)\cup\left(\frac{2}{3},\infty\right)$$

Range:

$$\left(-\infty,-\frac{1}{9}\right)\cup\left(-\frac{1}{9},\infty\right)$$

33.

$$-2.432$$

34.

$$\left\{-\frac{3y-2}{7y+4}\right\}$$

35.

$$\left\{-\frac{2a}{9}\right\}$$

36.

$$\left\{\frac{9y+5}{10y-3}\right\}$$

37.

$$\left\{-\frac{2a}{5}-\frac{\sqrt{(2a-5)(2a+5)}}{5},-\frac{2a}{5}+\frac{\sqrt{(2a-5)(2a+5)}}{5}\right\}$$

38. Domain:

$$\left(-\infty,\frac{3}{4}\right)\cup\left(\frac{3}{4},\infty\right)$$

Range:

$$\left(-\infty,\frac{3}{4}\right)\cup\left(\frac{3}{4},\infty\right)$$

39. Domain:

$$(-\infty,-1)\cup(-1,\infty)$$

Range:

$$\left(-\infty,-\frac{7}{10}\right)\cup\left(-\frac{7}{10},\infty\right)$$

40. Domain:

$$\left(-\infty, \frac{10}{9}\right) \cup \left(\frac{10}{9}, \infty\right)$$

Range:

$$\left(-\infty, -\frac{8}{9}\right) \cup \left(-\frac{8}{9}, \infty\right)$$

41.

$$-5.647$$

42.

$$-\frac{4}{11} < a, a < 0$$

43.

$$-1.304$$

44. Domain:

$$(-\infty, -1) \cup (-1, \infty)$$

Range:

$$\left(-\infty, -\frac{1}{8}\right) \cup \left(-\frac{1}{8}, \infty\right)$$

45.

$$-\frac{7}{4} < a, a < 0$$

46.

$$-20x^2 - 154x - 291$$

47.

$$\left\{\frac{y-1}{2 \cdot (2y-5)}\right\}$$

48.

$$4x^2 - 65x + 257$$

49.

$$0 < a, a < \frac{45}{46}$$

50. Domain:

$$\left(-\infty, \frac{8}{3}\right) \cup \left(\frac{8}{3}, \infty\right)$$

Range:

$$\left(-\infty, -\frac{10}{3}\right) \cup \left(-\frac{10}{3}, \infty\right)$$

51.

$$2.679$$

52.

$$6x^2+111x+515$$

53.

$$\left\{-3a-\sqrt{(3a-1)(3a+1)},-3a+\sqrt{(3a-1)(3a+1)}\right\}$$

54. Domain:

$$\left(-\infty,-\frac{7}{10}\right)\cup\left(-\frac{7}{10},\infty\right)$$

Range:

$$\left(-\infty,-\frac{3}{5}\right)\cup\left(-\frac{3}{5},\infty\right)$$

55.

$$\left\{-\frac{9a}{2}\right\}$$

56.

$$0<a,a<\frac{180}{277}$$

57.

$$-\frac{40}{9}<a,a<0$$

58.

$$\left\{-\frac{8a}{5}-\frac{7}{5}\right\}$$

59.

$$\left\{\frac{6}{13}-\frac{4a}{13}\right\}$$

60.

$$\left\{\frac{3(y-1)}{3y+1}\right\}$$

61.

$$\left\{-\frac{2\cdot(2y-5)}{5y+3}\right\}$$

62. Domain:

$$\left(-\infty,-\frac{2}{7}\right)\cup\left(-\frac{2}{7},\infty\right)$$

Range:

$$\left(-\infty,-\frac{10}{7}\right)\cup\left(-\frac{10}{7},\infty\right)$$

63.

$$-6.197$$

64.

$$\left\{\frac{a}{12}-\frac{\sqrt{a^2-216}}{12},\frac{a}{12}+\frac{\sqrt{a^2-216}}{12}\right\}$$

65.

$$-32x^2+28x-7$$

66.

$$0<a,a<\frac{5}{14}$$

67.

$$0<a,a<9$$

68. Domain:

$$\left(-\infty,-\frac{3}{2}\right)\cup\left(-\frac{3}{2},\infty\right)$$

Range:

$$\left(-\infty,-\frac{7}{2}\right)\cup\left(-\frac{7}{2},\infty\right)$$

69.

$$\left\{-\frac{a+5}{5a}-\frac{\sqrt{-49a^2+45a+25}}{5a},-\frac{a+5}{5a}+\frac{\sqrt{-49a^2+45a+25}}{5a}\right\}$$

70.

$$250x^2+530x+281$$

71. Domain:

$$\left(-\infty,\frac{3}{2}\right)\cup\left(\frac{3}{2},\infty\right)$$

Range:

$$\left(-\infty,\frac{7}{2}\right)\cup\left(\frac{7}{2},\infty\right)$$

72.

$$-2.028$$

73.

$$\left\{\frac{10y-9}{4y-3}\right\}$$

74.

$$0<a, a<\frac{360}{121}$$

75.

$$\left\{\frac{6(y+1)}{9y-8}\right\}$$

76. Domain:

$$(-\infty,-1)\cup(-1,\infty)$$

Range:

$$\left(-\infty,\frac{9}{8}\right)\cup\left(\frac{9}{8},\infty\right)$$

77.

$$32x^2-102x+85$$

78.

$$\left\{-\frac{3(y+1)}{8y-7}\right\}$$

79.

$$0<a, a<\frac{65}{4}$$

80.

$$0<a, a<\frac{8}{15}$$

81.

$$\left\{-\frac{8a-5}{18a}-\frac{\sqrt{-404a^2-80a+25}}{18a}, -\frac{8a-5}{18a}+\frac{\sqrt{-404a^2-80a+25}}{18a}\right\}$$

82.

$$0<a, a<\frac{3}{8}$$

83.

$$-4x^2-42x-101$$

84.

$$-\frac{64}{33} < a, a < 0$$

85.

$$-1.333$$

86.

$$\left\{ \frac{10a-1}{6a} - \frac{\sqrt{220a^2-104a+1}}{6a}, \frac{10a-1}{6a} + \frac{\sqrt{220a^2-104a+1}}{6a} \right\}$$

87.

$$-5.727$$

88. Domain:

$$(-\infty, 1) \cup (1, \infty)$$

Range:

$$\left(-\infty, -\frac{5}{2}\right) \cup \left(-\frac{5}{2}, \infty\right)$$

89.

$$-0.867$$

90. Domain:

$$\left(-\infty, -\frac{1}{2}\right) \cup \left(-\frac{1}{2}, \infty\right)$$

Range:

$$\left(-\infty, \frac{4}{5}\right) \cup \left(\frac{4}{5}, \infty\right)$$

91. Domain:

$$(-\infty, -1) \cup (-1, \infty)$$

Range:

$$\left(-\infty, \frac{2}{3}\right) \cup \left(\frac{2}{3}, \infty\right)$$

92.

$$\emptyset$$

93.

$$0.526$$

94. Domain:

$$(-\infty,-1)\cup(-1,\infty)$$

Range:

$$\left(-\infty,-\frac{1}{4}\right)\cup\left(-\frac{1}{4},\infty\right)$$

95.

$$-\frac{8}{5}<a,a<0$$

96.

$$\emptyset$$

97.

$$\left\{\frac{6a}{5}-\frac{2}{5}\right\}$$

98.

$$\left\{\frac{2}{3}-\frac{7a}{3}\right\}$$

99.

$$0.907$$

100.

$$0<a,a<1$$

101.

$$-4x^2+32x-57$$

102.

$$-256x^2-464x-202$$

103.

$$\left\{-\frac{a}{4}-\frac{\sqrt{25a^2+32}}{20},-\frac{a}{4}+\frac{\sqrt{25a^2+32}}{20}\right\}$$

104.

$$\left\{-\frac{2a}{3}-\frac{\sqrt{5}\sqrt{20a^2-3}}{15},-\frac{2a}{3}+\frac{\sqrt{5}\sqrt{20a^2-3}}{15}\right\}$$

105.

$$108x^2+378x+328$$

106.

$$0 < a, a < 80$$

107.

$$50x^2 - 245x + 283$$

108.

$$\left\{-\frac{4a}{9} - \frac{1}{3}\right\}$$

109.

$$\left\{\frac{3a}{7}\right\}$$

110.

$$\left\{\frac{2 \cdot (2a-1)}{5a} - \frac{\sqrt{-14a^2+19a+4}}{5a}, \frac{2 \cdot (2a-1)}{5a} + \frac{\sqrt{-14a^2+19a+4}}{5a}\right\}$$

111. Domain:

$$\left(-\infty, \frac{9}{10}\right) \cup \left(\frac{9}{10}, \infty\right)$$

Range:

$$\left(-\infty, -\frac{1}{5}\right) \cup \left(-\frac{1}{5}, \infty\right)$$

112.

$$162x^2 - 171x + 52$$

113. Domain:

$$\left(-\infty, -\frac{4}{3}\right) \cup \left(-\frac{4}{3}, \infty\right)$$

Range:

$$\left(-\infty, -\frac{10}{3}\right) \cup \left(-\frac{10}{3}, \infty\right)$$

114.

$$-\frac{10}{53} < a, a < 0$$

115.

$$0.818$$

116.

$$24x^2 + 258x + 686$$

117.

$$\left\{-\frac{3y+8}{7y+5}\right\}$$

118.

$$0 < a, a < \frac{3}{2}$$

119.

$$324x^2 - 1020x + 790$$

120.

$$\left\{\frac{a}{20} - \frac{\sqrt{a^2+5}}{20}, \frac{a}{20} + \frac{\sqrt{a^2+5}}{20}\right\}$$

121.

$$\left\{-\frac{5(y+1)}{y+9}\right\}$$

122. Domain:

$$(-\infty, 4) \cup (4, \infty)$$

Range:

$$(-\infty, 5) \cup (5, \infty)$$

123.

$$\left\{-\frac{5a}{14} - \frac{\sqrt{225a^2-28}}{42}, -\frac{5a}{14} + \frac{\sqrt{225a^2-28}}{42}\right\}$$

124.

$$-21.0$$

125.

$$256x^2 - 496x + 231$$

126.

$$\left\{\frac{a}{5} - \frac{\sqrt{3}\sqrt{3a^2-10}}{15}, \frac{a}{5} + \frac{\sqrt{3}\sqrt{3a^2-10}}{15}\right\}$$

127.

$$\left\{\frac{8y+9}{y+6}\right\}$$

128. Domain:

$$\left(-\infty,-\frac{4}{5}\right)\cup\left(-\frac{4}{5},\infty\right)$$

Range:

$$\left(-\infty,-\frac{2}{5}\right)\cup\left(-\frac{2}{5},\infty\right)$$

129.

$$-18x^2-60x-41$$

130.

$$\left\{-\frac{5a}{8}-\frac{\sqrt{225a^2-32}}{24},-\frac{5a}{8}+\frac{\sqrt{225a^2-32}}{24}\right\}$$

131.

$$54x^2+387x+681$$

132.

$$4x^2+70x+302$$

133.

$$\left\{\frac{8y+5}{7y+1}\right\}$$

134.

$$\left\{\frac{a}{2}-\frac{\sqrt{2}\sqrt{2a^2+9}}{4},\frac{a}{2}+\frac{\sqrt{2}\sqrt{2a^2+9}}{4}\right\}$$

135.

$$-\frac{96}{145}<a,a<0$$

136.

$$\left\{-4a-\frac{2\sqrt{36a^2+1}}{3},-4a+\frac{2\sqrt{36a^2+1}}{3}\right\}$$

137.

$$1.333$$

138. Domain:

$$\left(-\infty,\frac{2}{9}\right)\cup\left(\frac{2}{9},\infty\right)$$

Range:

$$\left(-\infty,-\frac{8}{9}\right)\cup\left(-\frac{8}{9},\infty\right)$$

139.

$$\left\{\frac{3y-4}{6y+7}\right\}$$

140.

$$\left\{\frac{3a}{4}-\frac{3\sqrt{5}\sqrt{5a^2-4}}{20},\frac{3a}{4}+\frac{3\sqrt{5}\sqrt{5a^2-4}}{20}\right\}$$

141.

$$-\frac{33}{20}<a,a<0$$

142.

$$-98x^2-35x+3$$

143.

$$\left\{-\frac{4y+5}{4\cdot(2y-1)}\right\}$$

144.

$$\left\{-\frac{9a}{8}-\frac{\sqrt{81a^2-20}}{8},-\frac{9a}{8}+\frac{\sqrt{81a^2-20}}{8}\right\}$$

145. Domain:

$$(-\infty,-4)\cup(-4,\infty)$$

Range:

$$(-\infty,1)\cup(1,\infty)$$

146.

$$0<a,a<\frac{54}{61}$$

147.

3.522

148.

2.602

149.

0.095

150.

$$-63x^2+195x-158$$

151.

$$0 < a, a < \frac{56}{9}$$

152.

$$-36x^2 - 128x - 105$$

153.

$$-\frac{7}{8} < a, a < 0$$

154.

$$0 < a, a < \frac{14}{37}$$

155.

$$294x^2 + 742x + 459$$

156.

$$\left\{ \frac{3a}{14} - \frac{\sqrt{5}\sqrt{45a^2 + 112}}{70}, \frac{3a}{14} + \frac{\sqrt{5}\sqrt{45a^2 + 112}}{70} \right\}$$

157.

$$-\frac{512}{377} < a, a < 0$$

158.

$$1.385$$

159.

$$-0.571$$

160.

$$0.656$$

161.

$$-\frac{32}{193} < a, a < 0$$

162.

$$-343x^2 - 581x - 243$$

163.

$$0 < a, a < 24$$

164.

$$\left\{-\frac{9y-8}{9y-4}\right\}$$

165.

$$-\frac{112}{9} < a, a < 0$$

166.

$$81x^2 - 39x + 11$$

167.

$$\left\{\frac{6a+5}{16a} - \frac{\sqrt{260a^2-228a+25}}{16a}, \frac{6a+5}{16a} + \frac{\sqrt{260a^2-228a+25}}{16a}\right\}$$

168. Domain:

$$(-\infty, 3) \cup (3, \infty)$$

Range:

$$(-\infty, -5) \cup (-5, \infty)$$

169.

$$-2.649$$

170.

$$\left\{-\frac{3a+8}{2a} - \frac{\sqrt{13a^2+8a+64}}{2a}, -\frac{3a+8}{2a} + \frac{\sqrt{13a^2+8a+64}}{2a}\right\}$$

171.

$$-\frac{64}{49} < a, a < 0$$

172.

$$0 < a, a < \frac{7}{74}$$

173.

$$\{1-a\}$$

174.

$$\left\{\frac{a}{6} - \frac{\sqrt{7}\sqrt{7a^2-24}}{42}, \frac{a}{6} + \frac{\sqrt{7}\sqrt{7a^2-24}}{42}\right\}$$

175.

$$\left\{\frac{2y-5}{3y+7}\right\}$$

176. Domain:

$$\left(-\infty, \frac{1}{3}\right) \cup \left(\frac{1}{3}, \infty\right)$$

Range:

$$(-\infty, -1) \cup (-1, \infty)$$

177.

$$0 < a, a < \frac{56}{25}$$

178.

$$54x^2 + 39x + 16$$

179.

$$\left\{\frac{a}{4} - \frac{\sqrt{21}\sqrt{21a^2+40}}{84}, \frac{a}{4} + \frac{\sqrt{21}\sqrt{21a^2+40}}{84}\right\}$$

180.

$$\left\{\frac{7a}{18} - \frac{\sqrt{49a^2+108}}{18}, \frac{7a}{18} + \frac{\sqrt{49a^2+108}}{18}\right\}$$

181.

$$-\frac{160}{329} < a, a < 0$$

182. Domain:

$$\left(-\infty, \frac{4}{5}\right) \cup \left(\frac{4}{5}, \infty\right)$$

Range:

$$(-\infty, -1) \cup (-1, \infty)$$

183.

$$0 < a, a < \frac{2}{21}$$

184. Domain:

$$(-\infty, 1) \cup (1, \infty)$$

Range:

$$(-\infty, -2) \cup (-2, \infty)$$

185.

$$-\frac{45}{43} < a, a < 0$$

186.

$$-360x^2+894x-563$$

187.

$$0.833$$

188.

$$-\frac{264}{25}<a,a<0$$

189.

$$5.625$$

190.

$$\left\{\frac{a}{9}-\frac{\sqrt{a^2+3}}{9},\frac{a}{9}+\frac{\sqrt{a^2+3}}{9}\right\}$$

191.

$$0.179$$

192.

$$-\frac{48}{121}<a,a<0$$

193.

$$-40<a,a<0$$

194.

$$\left\{\frac{7y+5}{3y-2}\right\}$$

195.

$$-\frac{84}{55}<a,a<0$$

196.

$$0<a,a<\frac{100}{29}$$

197.

$$\left\{-\frac{5y-6}{5\left(y-2\right)}\right\}$$

198.

$$\left\{\frac{3a-4}{16a}-\frac{\sqrt{297a^2+232a+16}}{16a},\frac{3a-4}{16a}+\frac{\sqrt{297a^2+232a+16}}{16a}\right\}$$

199. Domain:

$$(-\infty,-1)\cup(-1,\infty)$$

Range:

$$\left(-\infty,\frac{10}{7}\right)\cup\left(\frac{10}{7},\infty\right)$$

200.

$$0<a,a<\frac{56}{65}$$

3. Calculus

3.1 Problems

Exercise 3.1 Evaluate the following indefinite integral

$$\int 10t^{\frac{4}{5}}v^{\frac{5}{2}} + 10t^{\frac{2}{3}} + 9\sqrt{t} - 9t\sqrt[5]{v}dt$$

.

Exercise 3.2 Double derivative: Differentiate the following expression with respect to p twice

$$b^2\left(b^4p^4 + 10b^2 + 14b + 8p^5\right)$$

Exercise 3.3 Differentiate the following expression with respect to s

$$-70d^2s\sec\left(8ds^2\right) + 5\cot^3\left(5ds\right)$$

Exercise 3.4 Integrate the expression with respect to w

$$\frac{\sqrt{2}\cdot\left(5w+\frac{5}{2}\right)}{\sqrt{5w^2+5w+4}}$$

Exercise 3.5 Differentiate the following expression with respect to t

$$-6\tan\left(3s\right) + 10\sec\left(s^2\right)$$

Exercise 3.6 Integrate the polynomial with respect to d

$$-5d^2 + 5d + 10$$

Exercise 3.7 Integrate the expression with respect to y

$$\frac{5}{2\sqrt{5y+8}}$$

Exercise 3.8 Integrate the expression with respect to s

$$\frac{2s+1}{\sqrt{2s^2+2s-9}}$$

Exercise 3.9 Differentiate the polynomial with respect to v

$$7v^3 - 5v^2 - 3v - 10$$

Exercise 3.10 Double derivative: Differentiate the following expression with respect to d twice

$$l^2 \cdot \left(5d^6 l + 7d^5 + 10d^3 l + 10d^2 l - 3\right)$$

Exercise 3.11 Evaluate the definite integral for the following function, where the limits are 1 and 2.

$$f(q) = 5\sqrt[6]{q} - 4q^{\frac{3}{2}} + 8\sqrt{q}$$

Exercise 3.12 Differentiate the following expression with respect to z

$$-6e^{10z}\cos\left(5q\right) + 4\tan^2\left(3q^2 z\right)$$

Exercise 3.13 Double derivative: Differentiate the following expression with respect to q twice

$$q^2 t^2 \cdot \left(8q^4 t + q^2 + 8t^2\right)$$

Exercise 3.14 Evaluate the following indefinite integral

$$\int 3t^5 - 2t^4 v^5 + 5v dt$$

.

Exercise 3.15 Differentiate the polynomial with respect to w

$$w^2 - w + 7$$

Exercise 3.16 Differentiate the following expression with respect to c

$$-\frac{35e^{9c^2}}{\sin^2\left(7cz^2\right)} - \frac{9}{\tan\left(10c\right)}$$

Exercise 3.17 Integrate the expression with respect to n

$$-\frac{9}{2\sqrt{-9n-5}}$$

Exercise 3.18 Evaluate the following indefinite integral

$$\int 9n^5 w^4 - 2n^4 w + 7n^2 + 4w^3 + 10w^2 dw$$

.

Exercise 3.19 Differentiate the following expression with respect to q

$$70e^{8d^2 q}\sec\left(3d^2 q\right) - 6\cos^2\left(7dq^2\right)$$

Exercise 3.20 Differentiate the following expression with respect to b

$$\frac{-3\tan\left(7b^2 q^3\right) + 5\sec\left(b^3\right)}{4\sin^3\left(6b^3 q\right)}$$

Exercise 3.21 Double derivative: Differentiate the following expression with respect to n twice

$$n\left(-17n^4-4n^2q^2-nq^4-2\right)$$

Exercise 3.22 Integrate the polynomial with respect to a

$$-2a^4+10a^3+4a^2-3a-5$$

Exercise 3.23 Evaluate the following indefinite integral

$$\int 9w^{\frac{5}{6}}y-8w\sqrt{y}+8wy^2-7y^4-5dw$$

.

Exercise 3.24 Differentiate the following expression with respect to n

$$-6\sec^2\left(10n^2s^2\right)$$

Exercise 3.25 Differentiate the following expression with respect to m

$$-27e^{10m^2}\csc\left(5m^2\right)+2\csc^2\left(m^2\right)$$

Exercise 3.26 Double derivative: Differentiate the following expression with respect to s twice

$$10d^4s+5d^4-3s^5$$

Exercise 3.27 Differentiate the following expression with respect to z

$$30z^4\sec^2\left(7s^3z^2\right)+5\sin^3\left(2z\right)$$

Exercise 3.28 Differentiate the polynomial with respect to x

$$-2x^3+9x^2+9x+7$$

Exercise 3.29 Differentiate the following expression with respect to b

$$\frac{10\tan^3\left(9b\right)-3\sec^3\left(7b^2w\right)}{4\tan^2\left(3b\right)}$$

Exercise 3.30 Integrate the expression with respect to l

$$\frac{3\left(-4l-3\right)}{2\sqrt{-6l^2-9l-4}}$$

Exercise 3.31 Integrate the expression with respect to r

$$\frac{1008r^3}{\sin^2\left(8r^3\right)}+210r^2\cos\left(7r^3\right)-42\cot\left(8r^3\right)$$

Exercise 3.32 Differentiate the following expression with respect to n

$$7\tan^2\left(5n\right)+6\tan^2\left(10n^2y\right)$$

Exercise 3.33 Evaluate the following indefinite integral

$$\int 6c^{\frac{5}{6}}v^{\frac{5}{6}}-3c^{\frac{3}{5}}+5c^{\frac{5}{4}}v^6-8\sqrt[3]{c}\sqrt[5]{v}-5c\sqrt[6]{v}dv$$

.

Exercise 3.34 Integrate the expression with respect to l

$$\frac{-4l-9}{3\left(-2l^2-9l+7\right)^{\frac{2}{3}}}$$

Exercise 3.35 Differentiate the following expression with respect to m

$$12e^{4u^2}\cot\left(m^2u\right)$$

Exercise 3.36 Differentiate the polynomial with respect to y

$$-8y^3-7y^2-5y-6$$

Exercise 3.37 Integrate the expression with respect to n

$$-40\sin\left(4n\right)\cos\left(4n\right)-4\tan^2\left(4n\right)-4$$

Exercise 3.38 Differentiate the following expression with respect to l

$$-5l^{\frac{6}{5}}t^{\frac{4}{5}}-7l^{\frac{2}{3}}\sqrt[3]{t}+3l^{\frac{2}{3}}+10l^3$$

Exercise 3.39 Differentiate the following expression with respect to m

$$8m^2-6mq^2-3q^2-16$$

Exercise 3.40 Differentiate the following expression with respect to r

$$8\csc\left(3r^2\right)$$

Exercise 3.41 Integrate the expression with respect to c

$$-\frac{\sqrt{2}}{\sqrt{-2c-5}}$$

Exercise 3.42 Differentiate the following expression with respect to n

$$24a^3n^2\cos^3\left(3an^2\right)-7\sec^3\left(8an^3\right)$$

Exercise 3.43 Integrate the expression with respect to m

$$\frac{54\cos\left(9m\right)}{\sin^3\left(9m\right)}-\frac{70\cos\left(7m\right)}{\sin^3\left(7m\right)}$$

Exercise 3.44 Integrate the polynomial with respect to y

$$9y^2-8y-4$$

Exercise 3.45 Differentiate the following expression with respect to l

$$8\cot^2\left(10l\right)$$

Exercise 3.46 Double derivative: Differentiate the following expression with respect to m twice

$$8m^3v+v^6-7v^4+7$$

Exercise 3.47 Differentiate the following expression with respect to d

$$-3d^{\frac{2}{3}}\sqrt[3]{m}+4\sqrt{d}\sqrt[4]{m}+4d^4$$

Exercise 3.48 Integrate the expression with respect to c

$$40c\sin\left(2c^2\right)-24\tan\left(2c\right)\sec^2\left(2c\right)$$

Exercise 3.49 Differentiate the following expression with respect to m

$$-\frac{4}{\tan\left(5p\right)}-\frac{5}{\sin\left(2mp^2\right)}$$

Exercise 3.50 Integrate the expression with respect to c

$$\frac{2\cdot\left(2-c\right)}{3\left(-c^2+4c-9\right)^{\frac{2}{3}}}$$

Exercise 3.51 Integrate the expression with respect to v

$$\frac{7}{2\sqrt{7v+10}}$$

Exercise 3.52 Differentiate the following expression with respect to z

$$-3\cos^2\left(3z\right)-\frac{10}{\tan\left(7t^2z\right)}$$

Exercise 3.53 Evaluate the definite integral for the following function, where the limits are 2 and 5.

$$f(t)=4t^{\frac{5}{6}}+2t^{\frac{3}{5}}+4\sqrt{t}+9t-2$$

Exercise 3.54 Differentiate the following expression with respect to q

$$32e^{4n^2q^2}n^2q^3\sin^3\left(2n^2q^3\right)+5\cot^3\left(6q\right)$$

Exercise 3.55 Differentiate the following expression with respect to t

$$80e^{4t^2}\sec^2\left(5bt^2\right)+7\sin^2\left(6b\right)$$

Exercise 3.56 Integrate the polynomial with respect to n

$$-8n^3+7n^2-5n+2$$

Exercise 3.57 Differentiate the following expression with respect to l

$$-15e^{5d}\cos\left(9dl\right)$$

Exercise 3.58 Integrate the expression with respect to t

$$-\frac{216t^5\tan\left(3t^2\right)}{\cos^2\left(3t^2\right)}-72t^3\tan^2\left(3t^2\right)+96\cot\left(8t\right)\csc^2\left(8t\right)$$

Exercise 3.59 Differentiate the following expression with respect to v

$$-27dv^4\sin^2\left(d^2v^3\right)-6\sin^2\left(v^2\right)$$

Exercise 3.60 Differentiate the following expression with respect to t

$$16t^3\cos^2\left(4n^2t\right)+8\cos^3\left(7nt^2\right)$$

Exercise 3.61 Differentiate the following expression with respect to q

$$-18e^{2q}\cot^2\left(8b^2q^2\right)+8\tan\left(7q\right)$$

Exercise 3.62 Differentiate the following expression with respect to w

$$2\cos^2\left(5w^2\right)-2\sec\left(7n^2\right)$$

Exercise 3.63 Differentiate the polynomial with respect to s

$$6s^2+5s-4$$

Exercise 3.64 Integrate the expression with respect to l

$$l^2\cdot\left(4800l^3\tan\left(10l^2\right)\sec^3\left(10l^2\right)+320l\sec^3\left(10l^2\right)-900\sin^2\left(10l^3\right)\cos\left(10l^3\right)\right)$$

Exercise 3.65 Integrate the polynomial with respect to u

$$-6u^2-8u-3$$

Exercise 3.66 Differentiate the following expression with respect to r

$$48nr\cot^3\left(2nr\right)-5\csc^3\left(8n\right)$$

Exercise 3.67 Integrate the expression with respect to l

$$\frac{10}{3\left(10l-1\right)^{\frac{2}{3}}}$$

Exercise 3.68 Differentiate the following expression with respect to b

$$4\sqrt{b}c^3-4b^6c^{\frac{5}{4}}-3b^3c$$

Exercise 3.69 Integrate the expression with respect to b

$$-30\sin\left(6b\right)-90\cot\left(9b\right)\csc^2\left(9b\right)$$

Exercise 3.70 Differentiate the following expression with respect to b

$$\left(3\cos\left(6v^2\right)-2\sec^2\left(7b^3v\right)\right)\tan^3\left(6v^2\right)$$

Exercise 3.71 Differentiate the following expression with respect to t

$$63t\sin^2\left(6p^3t\right)+3\cot^3\left(9p^2t\right)$$

Exercise 3.72 Integrate the expression with respect to q

$$100\sin\left(20q\right)-\frac{24}{\cos^2\left(8q\right)}$$

Exercise 3.73 Differentiate the following expression with respect to w

$$48e^{10u^2w}\sec\left(5u^2w^2\right)$$

Exercise 3.74 Double derivative: Differentiate the following expression with respect to n twice

$$n^4 \cdot \left(3nq^6 - 4n + 5q^4\right)$$

Exercise 3.75 Differentiate the following expression with respect to w

$$-35u^4 \cos^3\left(5w^2\right) + 10\cot\left(5u^2w^2\right)$$

Exercise 3.76 Evaluate the following indefinite integral

$$\int 7\sqrt[3]{p}v^4 - p^{\frac{5}{2}} + 3p^{\frac{3}{2}} + 2\sqrt{p} + 5dv$$

.

Exercise 3.77 Evaluate the following indefinite integral

$$\int -10a^{\frac{5}{2}}\sqrt{l} - 2dl$$

.

Exercise 3.78 Differentiate the following expression with respect to m

$$-10\tan^2\left(3mv^2\right)$$

Exercise 3.79 Differentiate the following expression with respect to a

$$-100e^{7a^2}\cot^2\left(7t^2\right)$$

Exercise 3.80 Evaluate the following indefinite integral

$$\int -10\sqrt[5]{n}x^{\frac{3}{5}} + 6n^{\frac{2}{3}} - 9x^{\frac{5}{2}} + 10\sqrt{x}dx$$

.

Exercise 3.81 Integrate the expression with respect to u

$$6u\left(-\frac{324u^2\cot^2\left(4u^2\right)}{\sin^2\left(4u^2\right)} + 10\tan\left(5u^2\right)\sec^3\left(5u^2\right) + 27\cot^3\left(4u^2\right)\right)$$

Exercise 3.82 Integrate the expression with respect to d

$$\frac{d+1}{\sqrt{d^2+2d-5}}$$

Exercise 3.83 Differentiate the following expression with respect to c

$$10c^3\cot^3\left(2l\right) - 10\cos^3\left(9l^3\right)$$

Exercise 3.84 Evaluate the definite integral for the following function, where the limits are 3 and 4.

$$f(s) = -6s^{\frac{6}{5}} - 9s^2 + 10$$

Exercise 3.85 Differentiate the polynomial with respect to a

$$-2a^2 + 6a + 6$$

Exercise 3.86 Differentiate the polynomial with respect to q

$$-3q^3+4q^2-5q+3$$

Exercise 3.87 Differentiate the following expression with respect to d

$$d^{\frac{5}{6}}+4d^5-4dv^{\frac{3}{2}}-v^{\frac{5}{6}}-7v^2$$

Exercise 3.88 Differentiate the following expression with respect to r

$$-3\cot\left(7x^2\right)$$

Exercise 3.89 Double derivative: Differentiate the following expression with respect to x twice

$$5t^6+7t^4x-5t^2x-8x^2$$

Exercise 3.90 Integrate the expression with respect to t

$$12t\left(\frac{3}{\cos^2\left(9t^2\right)}-\frac{1}{\cos^2\left(2t^2\right)}\right)$$

Exercise 3.91 Integrate the expression with respect to u

$$\frac{5u-2}{\sqrt{5u^2-4u-1}}$$

Exercise 3.92 Differentiate the polynomial with respect to b

$$-4b^4+9b^3+10b^2+2b-5$$

Exercise 3.93 Differentiate the following expression with respect to b

$$\frac{\left(8\csc^3\left(4b^2m\right)-9\sec\left(6m^2\right)\right)\tan^2\left(8bm^2\right)}{2}$$

Exercise 3.94 Differentiate the following expression with respect to n

$$-9a^{\frac{3}{4}}-5a^{\frac{2}{3}}n^{\frac{6}{5}}+9\sqrt{a}-5a^3$$

Exercise 3.95 Evaluate the following indefinite integral

$$\int -9b^6-3bn^{\frac{3}{4}}+9n^{\frac{4}{5}}dn$$

.

Exercise 3.96 Differentiate the following expression with respect to d

$$2\sin^2\left(6z\right)-8\sec^2\left(10z\right)$$

Exercise 3.97 Differentiate the following expression with respect to n

$$3n\left(-2n^4x-5n^2+x^4\right)$$

Exercise 3.98 Integrate the expression with respect to c

$$18c^2\tan\left(c^3\right)\sec^2\left(c^3\right)-720c^2\cot\left(4c^2\right)\csc^2\left(4c^2\right)+45\csc^2\left(4c^2\right)$$

Exercise 3.99 Integrate the expression with respect to u

$$-3360u^2 \sin^2\left(10u^2\right) \cos\left(10u^2\right) - 18u^2 \cot\left(3u^3\right) \csc\left(3u^3\right) - 56\sin^3\left(10u^2\right)$$

Exercise 3.100 Integrate the expression with respect to w

$$-\frac{3}{2\sqrt{-w-1}}$$

Exercise 3.101 Differentiate the following expression with respect to c

$$7b^{\frac{5}{6}} + 6c^{\frac{3}{5}} + 6c^{\frac{2}{3}} + 8$$

Exercise 3.102 Evaluate the following indefinite integral

$$\int 4a^6 s^6 - 2a^4 + 7a^2 + 6s^6 + 8da$$

.

Exercise 3.103 Evaluate the following indefinite integral

$$\int 9r^{\frac{5}{4}} y^{\frac{3}{2}} - 3r^2 - 10\sqrt[5]{y} - 3y^{\frac{3}{2}} - 4dr$$

.

Exercise 3.104 Differentiate the following expression with respect to t

$$2\tan\left(4bt\right) + 10\csc^2\left(4b^2t^2\right)$$

Exercise 3.105 Evaluate the definite integral for the following function, where the limits are 0 and 1.

$$f(u) = 3u^{\frac{4}{3}} - 4u^{\frac{3}{2}} + \sqrt{u} - 1$$

Exercise 3.106 Evaluate the following indefinite integral

$$\int -\sqrt[3]{c}\sqrt[3]{w} + 3wdw$$

.

Exercise 3.107 Differentiate the following expression with respect to q

$$-5b^5 + 7b^3q^5 - 6b^2q^2 - 9b + 8q^2$$

Exercise 3.108 Differentiate the following expression with respect to u

$$\frac{\frac{3\sin^3\left(10s^3\right)}{4} + \cos\left(10s^2\right)}{\tan\left(2s^2\right)}$$

Exercise 3.109 Differentiate the following expression with respect to v

$$\frac{-3\cos^2\left(4v\right) + 2\csc^2\left(8z^3\right)}{8\cos\left(8v^2\right)}$$

Exercise 3.110 Differentiate the polynomial with respect to q

$$-5q^3 - 4q^2 - 4q - 10$$

Exercise 3.111 Double derivative: Differentiate the following expression with respect to w twice

$$-b^4w^4+3b^2w-3b^2-w^3$$

Exercise 3.112 Evaluate the following indefinite integral

$$\int s\left(-9s^3+7s^2t^6+10t^2\right)ds$$

.

Exercise 3.113 Differentiate the following expression with respect to y

$$-48e^{6yz^2}\cos^2\left(5yz\right)$$

Exercise 3.114 Integrate the expression with respect to l

$$-\frac{\sqrt[3]{3}}{\left(-3l-2\right)^{\frac{2}{3}}}$$

Exercise 3.115 Double derivative: Differentiate the following expression with respect to u twice

$$-15q^4+qu^4+2u^3$$

Exercise 3.116 Differentiate the following expression with respect to w

$$-54w^3\cot\left(10l^3\right)-3\sec^3\left(6l^2\right)$$

Exercise 3.117 Integrate the expression with respect to q

$$12q\left(\frac{\sin\left(2q^2\right)}{2}-9\tan\left(9q^2\right)\sec\left(9q^2\right)\right)$$

Exercise 3.118 Double derivative: Differentiate the following expression with respect to m twice

$$m^3\cdot\left(9m^2p^2-8m^2+8p^5\right)$$

Exercise 3.119 Differentiate the following expression with respect to u

$$-\frac{20du}{\cos\left(2d^2u^2\right)}-\frac{7}{\tan^2\left(du\right)}$$

Exercise 3.120 Integrate the expression with respect to v

$$\frac{3-2v}{3\left(-v^2+3v+9\right)^{\frac{2}{3}}}$$

Exercise 3.121 Integrate the polynomial with respect to c

$$c^2+2c-10$$

Exercise 3.122 Differentiate the following expression with respect to y

$$-2e^{9y^2}\tan^2\left(4y\right)$$

Exercise 3.123 Differentiate the following expression with respect to z

$$-7r^{\frac{2}{3}}\sqrt[4]{z}-8r^{\frac{3}{2}}+r^2$$

Exercise 3.124 Evaluate the definite integral for the following function, where the limits are 2 and 4.

$$f(v)=3$$

Exercise 3.125 Evaluate the definite integral for the following function, where the limits are 3 and 4.

$$f(b)=-2b^{\frac{3}{5}}+10b^{\frac{2}{3}}+7\sqrt{b}-10b^2-3b$$

Exercise 3.126 Differentiate the following expression with respect to l

$$\frac{-\cos(5w)-5\sec^3\left(2lw^3\right)}{2\cos\left(4w^3\right)}$$

Exercise 3.127 Integrate the expression with respect to v

$$-\frac{1}{3\left(3-v\right)^{\frac{2}{3}}}$$

Exercise 3.128 Integrate the expression with respect to x

$$-\frac{168x^4}{\sin^2\left(3x^2\right)}+84x^2\cot\left(3x^2\right)+105\cot\left(5x\right)\csc^3\left(5x\right)$$

Exercise 3.129 Differentiate the following expression with respect to m

$$-8e^{10m}\cos^2\left(2m^2r^2\right)$$

Exercise 3.130 Differentiate the following expression with respect to p

$$-5\sqrt[6]{p}-7p^6q+7p$$

Exercise 3.131 Differentiate the following expression with respect to b

$$4\cos\left(2bz^2\right)$$

Exercise 3.132 Evaluate the following indefinite integral

$$\int -6s^5z^2-9s^3z^4-2s^3-3z^2dz$$

.

Exercise 3.133 Differentiate the following expression with respect to w

$$21w^2y^4\sec^3\left(2wy^3\right)-4\tan^2\left(2wy^3\right)$$

Exercise 3.134 Integrate the expression with respect to l

$$\frac{\sqrt{2}}{2\sqrt{l-4}}$$

Exercise 3.135 Integrate the expression with respect to n

$$40n\left(18n^2\tan\left(2n^2\right)\sec^3\left(2n^2\right)-5\cot\left(10n^2\right)\csc^2\left(10n^2\right)+3\sec^3\left(2n^2\right)\right)$$

Exercise 3.136 Differentiate the following expression with respect to t

$$\frac{\left(2\tan^3\left(n\right)+5\cot\left(nt^3\right)\right)\sin\left(10n^3\right)}{5}$$

Exercise 3.137 Differentiate the following expression with respect to l

$$18e^{6lx^2}\cot^2\left(7l^2x^2\right)$$

Exercise 3.138 Evaluate the following indefinite integral

$$\int 8r^{\frac{6}{5}}v^{\frac{3}{2}}-6r^{\frac{5}{3}}-10r^{\frac{3}{2}}v+3dv$$

.

Exercise 3.139 Integrate the expression with respect to v

$$1600v^2\cot\left(5v^2\right)\csc^2\left(5v^2\right)+14v\sin\left(2v^2\right)-80\csc^2\left(5v^2\right)$$

Exercise 3.140 Evaluate the following indefinite integral

$$\int 7n^4t-6n-5t^6+10t^4+10tdn$$

.

Exercise 3.141 Differentiate the following expression with respect to s

$$8b^3s^4+8b^2s^5-4b+8s^5+6$$

Exercise 3.142 Differentiate the following expression with respect to s

$$-7\sec^2\left(y\right)$$

Exercise 3.143 Differentiate the following expression with respect to w

$$-6\tan\left(3lw\right)$$

Exercise 3.144 Differentiate the following expression with respect to c

$$c^{\frac{3}{5}}d^6-7c^{\frac{3}{2}}d-3d-8$$

Exercise 3.145 Differentiate the following expression with respect to n

$$-18e^{10y^2}\sin\left(2n^2y^2\right)-6\sec^2\left(2ny\right)$$

Exercise 3.146 Differentiate the polynomial with respect to b

$$-2b^4+4b^3+8b^2-9b+6$$

Exercise 3.147 Evaluate the definite integral for the following function, where the limits are 1 and 2.

$$f(s)=-4s^{\frac{6}{5}}-6s^{\frac{2}{3}}+8s^4$$

Exercise 3.148 Differentiate the following expression with respect to l

$$5d^{\frac{3}{2}}l^{\frac{3}{5}} - 10d^2\sqrt[3]{l} + 5dl + 9d + 8l^{\frac{2}{3}}$$

Exercise 3.149 Differentiate the following expression with respect to a

$$9\cot\left(9z^2\right)$$

Exercise 3.150 Differentiate the following expression with respect to v

$$18e^{4v}\cos^2\left(10vx^2\right) + 6\sin\left(x^2\right)$$

Exercise 3.151 Differentiate the polynomial with respect to y

$$-3y^4 + 2y^3 - 6y^2 + 7y - 5$$

Exercise 3.152 Integrate the expression with respect to z

$$216z^4\tan\left(3z^3\right)\sec^2\left(3z^3\right) + 24z\sec^2\left(3z^3\right) + 28\cot\left(2z\right)\csc^2\left(2z\right)$$

Exercise 3.153 Differentiate the following expression with respect to t

$$-60e^{4rt}\sin^2\left(7r\right)$$

Exercise 3.154 Differentiate the following expression with respect to a

$$2a^3 - 6a + 4w^4$$

Exercise 3.155 Differentiate the following expression with respect to n

$$-6\cos\left(10n\right) + 7\tan\left(9n^2z^2\right)$$

Exercise 3.156 Differentiate the following expression with respect to d

$$-6\sin\left(8d\right)$$

Exercise 3.157 Differentiate the polynomial with respect to t

$$-9t^4 + t^3 + 5t^2 + 3t + 3$$

Exercise 3.158 Integrate the expression with respect to z

$$\frac{3}{2\sqrt{3z+5}}$$

Exercise 3.159 Differentiate the following expression with respect to m

$$8\sqrt[4]{m} + 3m^{\frac{3}{2}} - 7m^6 - 8m^2$$

Exercise 3.160 Integrate the expression with respect to q

$$\frac{7\cdot\left(1-2q\right)}{3\left(-7q^2+7q-9\right)^{\frac{2}{3}}}$$

Exercise 3.161 Differentiate the following expression with respect to u

$$d^3\left(-4d^3 + d^2 - 6u + 8\right)$$

Exercise 3.162 Differentiate the following expression with respect to u

$$12n^4u^5 - 2n^3 - 8$$

Exercise 3.163 Differentiate the following expression with respect to a

$$-24ae^{6a^2y}\cos^3\left(a^2\right) + 9\tan^2\left(8a^2y^2\right)$$

Exercise 3.164 Differentiate the polynomial with respect to q

$$-3q^2 - 10q + 9$$

Exercise 3.165 Evaluate the following indefinite integral

$$\int r\left(8q^5 + 5q^4r^2 - 6r^5 - 2r\right)dq$$

.

Exercise 3.166 Differentiate the polynomial with respect to u

$$-10u^4 + 7u^3 - 10u^2 + 8u - 7$$

Exercise 3.167 Differentiate the following expression with respect to z

$$\frac{2\left(-4\cot^3\left(7m^3\right) - \csc^2\left(8z^3\right)\right)}{7\tan\left(3m^3z\right)}$$

Exercise 3.168 Integrate the expression with respect to z

$$-400z\tan\left(10z^2\right)\sec^2\left(10z^2\right) - 72\sin\left(4z\right)\cos\left(4z\right)$$

Exercise 3.169 Double derivative: Differentiate the following expression with respect to c twice

$$z\left(-6c^4 - c^3z^2 + 10z^3 + 9z\right)$$

Exercise 3.170 Differentiate the following expression with respect to c

$$c\left(-c^2 + 3cy - 6\right)$$

Exercise 3.171 Evaluate the following indefinite integral

$$\int 10\sqrt[5]{t}y^{\frac{6}{5}} + 3\sqrt{t}y^{\frac{5}{6}} + 7\sqrt{t} + 2t\sqrt[3]{y} + 4t\sqrt{y}dy$$

.

Exercise 3.172 Differentiate the following expression with respect to p

$$10l^3\cos^2\left(7p^2\right) + 8\sec^3\left(l^3p^3\right)$$

Exercise 3.173 Differentiate the following expression with respect to m

$$14n^4\tan^3\left(8m^2\right) + 3\cos^2\left(m\right)$$

Exercise 3.174 Evaluate the following indefinite integral

$$\int 2n^{\frac{4}{5}} + 8n^3\sqrt{s} + 10s^{\frac{5}{2}} - 9s^2dn$$

.

Exercise 3.175 Differentiate the following expression with respect to r

$$\frac{-8\cos^3\left(2r^2\right)+7\cot^3\left(7ar\right)}{4\cos^2\left(3a^2r^2\right)}$$

Exercise 3.176 Differentiate the polynomial with respect to n

$$2n^3-8n^2+3n-8$$

Exercise 3.177 Differentiate the polynomial with respect to w

$$-3w^3-10w^2+6w+2$$

Exercise 3.178 Differentiate the following expression with respect to t

$$20e^{4t^2}\sec\left(d^2t\right)$$

Exercise 3.179 Integrate the expression with respect to x

$$\frac{18x-1}{3\left(9x^2-x+9\right)^{\frac{2}{3}}}$$

Exercise 3.180 Integrate the expression with respect to q

$$3q\left(-1176q^4\sin^2\left(8q^3\right)\cos\left(8q^3\right)-49q\sin^3\left(8q^3\right)-\frac{200\tan^2\left(10q^2\right)}{\cos^2\left(10q^2\right)}\right)$$

Exercise 3.181 Differentiate the following expression with respect to m

$$-9m^4v^3+18m^4-6m^2v^5-9$$

Exercise 3.182 Evaluate the definite integral for the following function, where the limits are 3 and 7.

$$f(d)=1-d$$

Exercise 3.183 Integrate the expression with respect to x

$$\frac{-3x-5}{\sqrt{-3x^2-10x-5}}$$

Exercise 3.184 Differentiate the following expression with respect to r

$$-224e^{5n}n^4r^2\sin\left(r\right)-10\cos^2\left(2n^2r\right)$$

Exercise 3.185 Integrate the expression with respect to x

$$\frac{7\cdot\left(2x-1\right)}{3\left(7x^2-7x-9\right)^{\frac{2}{3}}}$$

Exercise 3.186 Integrate the expression with respect to p

$$p^2\cdot\left(\frac{108p^3\cos\left(p^3\right)}{\sin^3\left(p^3\right)}+\frac{30}{\sin^2\left(2p^3\right)}-\frac{54}{\sin^2\left(p^3\right)}\right)$$

Exercise 3.187 Integrate the expression with respect to w

$$-\frac{180\cos(9w)}{\sin^3(9w)} - \frac{140\cos(7w)}{\sin^3(7w)}$$

Exercise 3.188 Differentiate the following expression with respect to x

$$4\tan\left(6x^2\right) - 3\cot(lx)$$

Exercise 3.189 Differentiate the polynomial with respect to s

$$-10s^2 - 5s + 10$$

Exercise 3.190 Differentiate the following expression with respect to s

$$-9\cos(9s)$$

Exercise 3.191 Integrate the expression with respect to m

$$\frac{8}{\sin^2(2m)} + \frac{5}{\sin^2(m)}$$

Exercise 3.192 Differentiate the polynomial with respect to p

$$8p^4 - 5p^3 + 7p^2 - p - 4$$

Exercise 3.193 Differentiate the following expression with respect to b

$$-60e^{9r^2}\sin(3b) + 10\tan\left(7b^2r^2\right)$$

Exercise 3.194 Differentiate the following expression with respect to n

$$\frac{\left(-4\cos^2\left(10ns^2\right) + 3\cot^3\left(5n^2s^3\right)\right)\tan\left(5n^2s\right)}{9}$$

Exercise 3.195 Evaluate the following indefinite integral

$$\int t^3w + 8w^5 - w^2 - 6w + 4dw$$

.

Exercise 3.196 Differentiate the following expression with respect to b

$$-7\cos^2\left(7b^2v^2\right) - \frac{9}{\tan^2\left(6b^2v^2\right)}$$

Exercise 3.197 Differentiate the following expression with respect to r

$$3r^6 - 10r^5t^4 + 4r^3t^3 + r^3t - 3$$

Exercise 3.198 Differentiate the following expression with respect to x

$$x\left(-9u^2x^4 + 8ux^5 - 2\right)$$

Exercise 3.199 Differentiate the following expression with respect to z

$$-10e^{6z}\csc\left(7r^2z\right) + 8\sec(2r)$$

Exercise 3.200 Integrate the expression with respect to n

$$-\frac{2}{3(9-2n)^{\frac{2}{3}}}$$

3.2 Solutions

1.

$$\frac{50t^{\frac{9}{5}}v^{\frac{5}{2}}}{9}+6t^{\frac{5}{3}}+6t^{\frac{3}{2}}-\frac{9t^2\sqrt[5]{v}}{2}$$

2.

$$b^2p^2\cdot\left(12b^4+160p\right)$$

3.

$$5d\left(-224d^2s^2\tan\left(8ds^2\right)\sec\left(8ds^2\right)-14d\sec\left(8ds^2\right)-\frac{15\cot^2\left(5ds\right)}{\sin^2\left(5ds\right)}\right)$$

4.

$$C+\sqrt{10w^2+10w+8}$$

5.

$$0$$

6.

$$\frac{5d\left(-2d^2+3d+12\right)}{6}$$

7.

$$C+\sqrt{5y+8}$$

8.

$$C+\sqrt{2s^2+2s-9}$$

9.

$$21v^2-10v-3$$

10.

$$l^2\cdot\left(150d^4l+140d^3+60dl+20l\right)$$

11. The indefinite integral is

$$\frac{30q^{\frac{7}{6}}}{7}-\frac{8q^{\frac{5}{2}}}{5}+\frac{16q^{\frac{3}{2}}}{3}$$

The value of the definite integral is 7.63603351830078.

12.

$$-60e^{10z}\log\left(e\right)\cos\left(5q\right)+\frac{24q^2\tan\left(3q^2z\right)}{\cos^2\left(3q^2z\right)}$$

13.

$$t^2\cdot\left(240q^4t+12q^2+16t^2\right)$$

14.

$$\frac{t\left(5t^5-4t^4v^5+50v\right)}{10}$$

15.

$$2w-1$$

16.

$$-\frac{630ce^{9c^2}\log\left(e\right)}{\sin^2\left(7cz^2\right)}+\frac{490e^{9c^2}z^2\cos\left(7cz^2\right)}{\sin^3\left(7cz^2\right)}+\frac{90}{\sin^2\left(10c\right)}$$

17.

$$C+\sqrt{-9n-5}$$

18.

$$\frac{w\left(27n^5w^4-15n^4w+105n^2+15w^3+50w^2\right)}{15}$$

19.

$$14d\left(40de^{8d^2q}\log\left(e\right)\sec\left(3d^2q\right)+15de^{8d^2q}\tan\left(3d^2q\right)\sec\left(3d^2q\right)+6q\sin\left(14dq^2\right)\right)$$

20.

$$\frac{3b\left(18bq\left(3\tan\left(7b^2q^3\right)-5\sec\left(b^3\right)\right)\cos\left(6b^3q\right)+\left(5b\tan\left(b^3\right)\sec\left(b^3\right)-\frac{14q^3}{\cos^2\left(7b^2q^3\right)}\right)\sin\left(6b^3q\right)\right)}{4\sin^4\left(6b^3q\right)}$$

21.

$$-340n^3-24nq^2-2q^4$$

22.

$$\frac{a\left(-12a^4+75a^3+40a^2-45a-150\right)}{30}$$

23.

$$\frac{54w^{\frac{11}{6}}y}{11}-4w^2\sqrt{y}+4w^2y^2-7wy^4-5w$$

24.

$$-240ns^2\tan\left(10n^2s^2\right)\sec^2\left(10n^2s^2\right)$$

25.

$$2m\left(-270e^{10m^2}\log\left(e\right)\csc\left(5m^2\right)+135e^{10m^2}\cot\left(5m^2\right)\csc\left(5m^2\right)-4\cot\left(m^2\right)\csc^2\left(m^2\right)\right)$$

26.

$$-60s^3$$

27.

$$840s^3z^5\tan\left(7s^3z^2\right)\sec^2\left(7s^3z^2\right)+120z^3\sec^2\left(7s^3z^2\right)+30\sin^2\left(2z\right)\cos\left(2z\right)$$

28.

$$-6x^2+18x+9$$

29.

$$\frac{3\cdot\left(3\left(-7bw\tan\left(7b^2w\right)\sec^3\left(7b^2w\right)+\frac{15\tan^2\left(9b\right)}{\cos^2\left(9b\right)}\right)\tan\left(3b\right)-\frac{10\tan^3\left(9b\right)-3\sec^3\left(7b^2w\right)}{\cos^2\left(3b\right)}\right)}{2\tan^3\left(3b\right)}$$

30.

$$C+\sqrt{-6l^2-9l-4}$$

31.

$$C-42r\cot\left(8r^3\right)+10\sin\left(7r^3\right)$$

32.

$$\frac{240ny\tan\left(10n^2y\right)}{\cos^2\left(10n^2y\right)}+\frac{70\tan\left(5n\right)}{\cos^2\left(5n\right)}$$

33.

$$\frac{36c^{\frac{5}{6}}v^{\frac{11}{6}}}{11}-3c^{\frac{3}{5}}v+\frac{5c^{\frac{5}{4}}v^7}{7}-\frac{20\sqrt[3]{c}v^{\frac{6}{5}}}{3}-\frac{30cv^{\frac{7}{6}}}{7}$$

34.

$$C+\sqrt[3]{-2l^2-9l+7}$$

35.

$$-\frac{24e^{4u^2}mu}{\sin^2\left(m^2u\right)}$$

36.

$$-24y^2-14y-5$$

37.

$$C+5\cos^2\left(4n\right)-\tan\left(4n\right)$$

38.

$$\frac{2\left(-9l^{\frac{8}{15}}t^{\frac{4}{5}}+45l^{\frac{7}{3}}-7\sqrt[3]{t}+3\right)}{3\sqrt[3]{l}}$$

39.

$$16m-6q^2$$

40.

$$-48r\cot\left(3r^2\right)\csc\left(3r^2\right)$$

41.

$$C+\sqrt{-4c-10}$$

42.

$$24an\left(-18a^3n^2\sin\left(3an^2\right)\cos^2\left(3an^2\right)+2a^2\cos^3\left(3an^2\right)-21n\tan\left(8an^3\right)\sec^3\left(8an^3\right)\right)$$

43.

$$C-3\cot^2(9m)+5\csc^2(7m)$$

44.

$$y\left(3y^2-4y-4\right)$$

45.

$$-\frac{160\cot(10l)}{\sin^2(10l)}$$

46.

$$48mv$$

47.

$$16d^3+\frac{2\sqrt[4]{m}}{\sqrt{d}}-\frac{2\sqrt[3]{m}}{\sqrt[3]{d}}$$

48.

$$C-10\cos\left(2c^2\right)-6\sec^2(2c)$$

49.

$$10p^2\cot\left(2mp^2\right)\csc\left(2mp^2\right)$$

50.

$$C+\sqrt[3]{-c^2+4c-9}$$

51.

$$C+\sqrt{7v+10}$$

52.

$$\frac{70l^2}{\sin^2\left(7l^2z\right)}+9\sin(6z)$$

53. The indefinite integral is

$$\frac{24t^{\frac{11}{6}}}{11}+\frac{5t^{\frac{8}{5}}}{4}+\frac{8t^{\frac{3}{2}}}{3}+\frac{9t^2}{2}-2t$$

The value of the definite integral is 157.335403624731.

54.

$$576e^{4n^2q^2}n^4q^5\sin^2\left(2n^2q^3\right)\cos\left(2n^2q^3\right)+256e^{4n^2q^2}n^4q^4\log\left(e\right)\sin^3\left(2n^2q^3\right)+96e^{4n^2q^2}n^2q^2\sin^3\left(2n^2q^3\right)-90\cot^4\left(6q\right)$$

55.

$$320e^{4t^2}t\left(5b\tan\left(5bt^2\right)+2\log\left(e\right)\right)\sec^2\left(5bt^2\right)$$

56.

$$\frac{n\left(-12n^3+14n^2-15n+12\right)}{6}$$

57.

$$135de^{5d}\sin\left(9dl\right)$$

58.

$$C-18t^4\tan^2\left(3t^2\right)-6\csc^2\left(8t\right)$$

59.

$$-81d^3v^6\sin\left(2d^2v^3\right)-108dv^3\sin^2\left(d^2v^3\right)-12v\sin\left(2v^2\right)$$

60.

$$16t\left(-8n^2t^2\sin\left(4n^2t\right)\cos\left(4n^2t\right)-21n\sin\left(7nt^2\right)\cos^2\left(7nt^2\right)+3t\cos^2\left(4n^2t\right)\right)$$

61.

$$\frac{576b^2e^{2q}q\cot\left(8b^2q^2\right)}{\sin^2\left(8b^2q^2\right)}-36e^{2q}\log\left(e\right)\cot^2\left(8b^2q^2\right)+56\tan^2\left(7q\right)+56$$

62.

$$-20w\sin\left(10w^2\right)$$

63.

$$12s+5$$

64.

$$C+80l^4\sec^3\left(10l^2\right)-10\sin^3\left(10l^3\right)$$

65.

$$u\left(-2u^2-4u-3\right)$$

66.

$$48n \left(-\frac{6nr}{\sin^2(2nr)} + \cot(2nr)\right) \cot^2(2nr)$$

67.

$$C + \sqrt[3]{10l - 1}$$

68.

$$-24b^5 c^{\frac{5}{4}} - 9b^2 c + \frac{2c^3}{\sqrt{b}}$$

69.

$$C - 10\sin^2(3b) + 5\csc^2(9b)$$

70.

$$-84b^2 v \tan^3\left(6v^2\right) \tan\left(7b^3 v\right) \sec^2\left(7b^3 v\right)$$

71.

$$378p^3 t \sin\left(12p^3 t\right) - \frac{81p^2 \cot^2\left(9p^2 t\right)}{\sin^2\left(9p^2 t\right)} + 63\sin^2\left(6p^3 t\right)$$

72.

$$C - 10\cos^2(10q) - 3\tan(8q)$$

73.

$$480e^{10u^2 w} u^2 \left(w\tan\left(5u^2 w^2\right) + \log(e)\right) \sec\left(5u^2 w^2\right)$$

74.

$$n^2 \cdot \left(60nq^6 - 80n + 60q^4\right)$$

75.

$$50u^2 w \left(21u^2 \sin\left(5w^2\right) \cos^2\left(5w^2\right) - \frac{2}{\sin^2\left(5u^2 w^2\right)}\right)$$

76.

$$v\left(\frac{7\sqrt[3]{p}v^4}{5} - p^{\frac{5}{2}} + 3p^{\frac{3}{2}} + 2\sqrt{p} + 5\right)$$

77.

$$-\frac{20a^{\frac{5}{2}} l^{\frac{3}{2}}}{3} - 2l$$

78.

$$-\frac{60v^2 \tan\left(3mv^2\right)}{\cos^2\left(3mv^2\right)}$$

79.

$$-1400ae^{7a^2}\log(e)\cot^2\left(7t^2\right)$$

80.

$$-\frac{25\sqrt[5]{n}x^{\frac{8}{5}}}{4}+6n^{\frac{2}{3}}x-\frac{18x^{\frac{7}{2}}}{7}+\frac{20x^{\frac{3}{2}}}{3}$$

81.

$$C+81u^2\cot^3\left(4u^2\right)+2\sec^3\left(5u^2\right)$$

82.

$$C+\sqrt{d^2+2d-5}$$

83.

$$30c^2\cot^3(2l)$$

84. The indefinite integral is

$$-\frac{30s^{\frac{11}{5}}}{11}-3s^3+10s$$

The value of the definite integral is -128.001494861345.

85.

$$6-4a$$

86.

$$-9q^2+8q-5$$

87.

$$20d^4-4v^{\frac{3}{2}}+\frac{5}{6\sqrt[6]{d}}$$

88.

$$0$$

89.

$$-16$$

90.

$$C-3\tan\left(2t^2\right)+2\tan\left(9t^2\right)$$

91.

$$C+\sqrt{5u^2-4u-1}$$

92.

$$-16b^3+27b^2+20b+2$$

93.

$$8m\left(-12b\cot\left(8bm^2\right)\cot\left(4b^2m\right)\csc^3\left(4b^2m\right)+\frac{m\left(8\csc^3\left(4b^2m\right)-9\sec\left(6m^2\right)\right)}{\sin^2\left(8bm^2\right)}\right)\tan^3\left(8bm^2\right)$$

94.

$$-6a^{\frac{2}{3}}\sqrt[5]{n}$$

95.

$$-9b^6n-\frac{12bn^{\frac{7}{4}}}{7}+5n^{\frac{9}{5}}$$

96.

$$0$$

97.

$$-30n^4x-45n^2+3x^4$$

98.

$$C+45c\csc^2\left(4c^2\right)+3\sec^2\left(c^3\right)$$

99.

$$C-56u\sin^3\left(10u^2\right)+2\csc\left(3u^3\right)$$

100.

$$C+3\sqrt{-w-1}$$

101.

$$\frac{4}{\sqrt[3]{c}}+\frac{18}{5c^{\frac{2}{5}}}$$

102.

$$\frac{a\left(60a^6s^6-42a^4+245a^2+630s^6+840\right)}{105}$$

103.

$$4r^{\frac{9}{4}}y^{\frac{3}{2}}-r^3-10r\sqrt[5]{y}-3ry^{\frac{3}{2}}-4r$$

104.

$$8b\left(-20bt\cot\left(4b^2t^2\right)\csc^2\left(4b^2t^2\right)+\tan^2\left(4bt\right)+1\right)$$

105. The indefinite integral is

$$\frac{9u^{\frac{7}{3}}}{7} - \frac{8u^{\frac{5}{2}}}{5} + \frac{2u^{\frac{3}{2}}}{3} - u$$

The value of the definite integral is -0.647619047619048.

106.

$$-\frac{3\sqrt[3]{c}w^{\frac{4}{3}}}{4} + \frac{3w^2}{2}$$

107.

$$q\left(35b^3q^3 - 12b^2 + 16\right)$$

108.

$$0$$

109.

$$\frac{-2v\left(3\cos^2(4v) - 2\csc^2\left(8z^3\right)\right)\sin\left(8v^2\right) + 3\sin(4v)\cos(4v)\cos\left(8v^2\right)}{\cos^2\left(8v^2\right)}$$

110.

$$-15q^2 - 8q - 4$$

111.

$$6w\left(-2b^4w - 1\right)$$

112.

$$\frac{s^2\left(-36s^3 + 35s^2t^6 + 100t^2\right)}{20}$$

113.

$$48e^{6yz^2}z\left(-3z\log(e)\cos(10yz) - 3z\log(e) + 5\sin(10yz)\right)$$

114.

$$C + \sqrt[3]{-9l - 6}$$

115.

$$12u(qu + 1)$$

116.

$$-162w^2\cot\left(10l^3\right)$$

117.

$$C - 3\cos^2\left(q^2\right) - 6\sec\left(9q^2\right)$$

118.

$$180m^3p^2 - 160m^3 + 48mp^5$$

119.

$$2d\left(-40d^2u^2\tan\left(2d^2u^2\right)\sec\left(2d^2u^2\right) - 10\sec\left(2d^2u^2\right) + \frac{7\cot\left(du\right)}{\sin^2\left(du\right)}\right)$$

120.

$$C + \sqrt[3]{-v^2 + 3v + 9}$$

121.

$$\frac{c\left(c^2 + 3c - 30\right)}{3}$$

122.

$$-4e^{9y^2}\cdot\left(9y\log\left(e\right)\tan\left(4y\right) + \frac{4}{\cos^2\left(4y\right)}\right)\tan\left(4y\right)$$

123.

$$-\frac{7r^{\frac{2}{3}}}{4z^{\frac{3}{4}}}$$

124. The indefinite integral is

$$3v$$

The value of the definite integral is 6.00000000000000.

125. The indefinite integral is

$$-\frac{5b^{\frac{8}{5}}}{4} + 6b^{\frac{5}{3}} + \frac{14b^{\frac{3}{2}}}{3} - \frac{10b^3}{3} - \frac{3b^2}{2}$$

The value of the definite integral is -101.951560607421.

126.

$$-\frac{15w^3\tan\left(2lw^3\right)\sec^3\left(2lw^3\right)}{\cos\left(4w^3\right)}$$

127.

$$C + \sqrt[3]{3 - v}$$

128.

$$C + 28x^3\cot\left(3x^2\right) - 7\csc^3\left(5x\right)$$

129.

$$e^{10m}\left(32mr^2\sin\left(4m^2r^2\right) - 40\log\left(e\right)\cos\left(4m^2r^2\right) - 40\log\left(e\right)\right)$$

130.

$$-42p^5q+7-\frac{5}{6p^{\frac{5}{6}}}$$

131.

$$-8z^2\sin\left(2bz^2\right)$$

132.

$$z\left(-\frac{9s^3z^4}{5}-2s^3+z^2\left(-2s^5-1\right)\right)$$

133.

$$\frac{y^3\left(-126w^2y^4\tan\left(2wy^3\right)-42wy+32\sin\left(wy^3\right)\cos\left(wy^3\right)\right)}{\left(2\sin^2\left(wy^3\right)-1\right)^3}$$

134.

$$C+\sqrt{2l-8}$$

135.

$$C+60n^2\sec^3\left(2n^2\right)+5\csc^2\left(10n^2\right)$$

136.

$$-\frac{3nt^2\sin\left(10n^3\right)}{\sin^2\left(nt^3\right)}$$

137.

$$36e^{6lx^2}x^2\left(-\frac{14l}{\sin^2\left(7l^2x^2\right)}+3\log\left(e\right)\cot\left(7l^2x^2\right)\right)\cot\left(7l^2x^2\right)$$

138.

$$\frac{16r^{\frac{6}{5}}v^{\frac{5}{2}}}{5}-6r^{\frac{5}{3}}v-5r^{\frac{3}{2}}v^2+3v$$

139.

$$C-80v\csc^2\left(5v^2\right)-7\cos^2\left(v^2\right)$$

140.

$$\frac{n\left(7n^4t-15n+25t\left(-t^5+2t^3+2\right)\right)}{5}$$

141.

$$s^3\cdot\left(32b^3+40b^2s+40s\right)$$

142.

$$0$$

143.

$$-\frac{18l}{\cos^2(3lw)}$$

144.

$$\frac{-105c^{\frac{9}{10}}d+6d^6}{10c^{\frac{2}{5}}}$$

145.

$$24y\left(-3e^{10y^2}ny\cos\left(2n^2y^2\right)-\tan(2ny)\sec^2(2ny)\right)$$

146.

$$-8b^3+12b^2+16b-9$$

147. The indefinite integral is

$$-\frac{20s^{\frac{11}{5}}}{11}-\frac{18s^{\frac{5}{3}}}{5}+\frac{8s^5}{5}$$

The value of the definite integral is 35.2347243894869.

148.

$$\frac{3d^{\frac{3}{2}}}{l^{\frac{2}{5}}}-\frac{10d^2}{3l^{\frac{2}{3}}}+5d+\frac{16}{3\sqrt[3]{l}}$$

149.

$$0$$

150.

$$36e^{4v}\left(-5x^2\sin\left(20vx^2\right)+\log(e)\cos\left(20vx^2\right)+\log(e)\right)$$

151.

$$-12y^3+6y^2-12y+7$$

152.

$$C+12z^2\sec^2\left(3z^3\right)-7\csc^2(2z)$$

153.

$$-240e^{4rt}r\log(e)\sin^2(7r)$$

154.

$$6a^2-6$$

155.

$$\frac{126nz^2}{\cos^2\left(9n^2z^2\right)}+60\sin(10n)$$

156.

$$-48\cos\left(8d\right)$$

157.

$$-36t^3+3t^2+10t+3$$

158.

$$C+\sqrt{3z+5}$$

159.

$$\frac{9\sqrt{m}}{2}-42m^5-16m+\frac{2}{m^{\frac{3}{4}}}$$

160.

$$C+\sqrt[3]{-7q^2+7q-9}$$

161.

$$-6d^3$$

162.

$$60n^4u^4$$

163.

$$-288a^2e^{6a^2y}y\log\left(e\right)\cos^3\left(a^2\right)+144a^2e^{6a^2y}\sin\left(a^2\right)\cos^2\left(a^2\right)+\frac{288ay^2\tan\left(8a^2y^2\right)}{\cos^2\left(8a^2y^2\right)}-24e^{6a^2y}\cos^3\left(a^2\right)$$

164.

$$-6q-10$$

165.

$$\frac{qr\left(4q^5+3q^4r^2-18r^5-6r\right)}{3}$$

166.

$$-40u^3+21u^2-20u+8$$

167.

$$\frac{6\left(\frac{m^3\cdot\left(4\cot^3\left(7m^3\right)+\csc^2\left(8z^3\right)\right)}{\cos^2\left(3m^3z\right)}+16z^2\tan\left(3m^3z\right)\cot\left(8z^3\right)\csc^2\left(8z^3\right)\right)}{7\tan^2\left(3m^3z\right)}$$

168.

$$C-9\sin^2\left(4z\right)-10\sec^2\left(10z^2\right)$$

169.

$$6cz\left(-12c-z^2\right)$$

170.

$$-3c^2+6cy-6$$

171.

$$\frac{50\sqrt[5]{t}y^{\frac{11}{5}}}{11}+\frac{18\sqrt{t}y^{\frac{11}{6}}}{11}+7\sqrt{t}y+\frac{3ty^{\frac{4}{3}}}{2}+\frac{8ty^{\frac{3}{2}}}{3}$$

172.

$$8l^3p\left(9p\tan\left(l^3p^3\right)\sec^3\left(l^3p^3\right)-\frac{35\sin\left(14p^2\right)}{2}\right)$$

173.

$$\frac{672mn^4\tan^2\left(8m^2\right)}{\cos^2\left(8m^2\right)}-3\sin\left(2m\right)$$

174.

$$\frac{10n^{\frac{9}{5}}}{9}+2n^4\sqrt{s}+10ns^{\frac{5}{2}}-9ns^2$$

175.

$$\frac{3\left(-4a^2r\left(8\cos^3\left(2r^2\right)-7\cot^3\left(7ar\right)\right)\sin\left(3a^2r^2\right)+\left(-\frac{49a\cot^2\left(7ar\right)}{\sin^2\left(7ar\right)}+32r\sin\left(2r^2\right)\cos^2\left(2r^2\right)\right)\cos\left(3a^2r^2\right)\right)}{4\cos^3\left(3a^2r^2\right)}$$

176.

$$6n^2-16n+3$$

177.

$$-9w^2-20w+6$$

178.

$$20e^{4t^2}\left(d^2\tan\left(d^2t\right)+8t\log\left(e\right)\right)\sec\left(d^2t\right)$$

179.

$$C+\sqrt[3]{9x^2-x+9}$$

180.

$$C-49q^3\sin^3\left(8q^3\right)-10\tan^3\left(10q^2\right)$$

181.

$$12m\left(-3m^2v^3+6m^2-v^5\right)$$

182. The indefinite integral is

$$\frac{d\,(2-d)}{2}$$

The value of the definite integral is -16.0000000000000.

183.

$$C+\sqrt{-3x^2-10x-5}$$

184.

$$n^2\left(-224e^{5n}n^2r^2\cos(r)-448e^{5n}n^2r\sin(r)+20\sin\left(4n^2r\right)\right)$$

185.

$$C+\sqrt[3]{7x^2-7x-9}$$

186.

$$C-18p^3\csc^2\left(p^3\right)-5\cot\left(2p^3\right)$$

187.

$$C+10\cot^2(7w)+10\csc^2(9w)$$

188.

$$\frac{3l}{\sin^2(lx)}+\frac{48x}{\cos^2\left(6x^2\right)}$$

189.

$$-20s-5$$

190.

$$81\sin(9s)$$

191.

$$C-5\cot(m)-4\cot(2m)$$

192.

$$32p^3-15p^2+14p-1$$

193.

$$\frac{140br^2}{\cos^2\left(7b^2r^2\right)}-180e^{9r^2}\cos(3b)$$

194.

$$10s\left(-\frac{n\left(4\cos^2\left(10ns^2\right)-3\cot^3\left(5n^2s^3\right)\right)}{\sin^2\left(5n^2s\right)}+s\left(-\frac{9ns\cot^2\left(5n^2s^3\right)}{\sin^2\left(5n^2s^3\right)}+4\sin\left(20ns^2\right)\right)\cot\left(5n^2s\right)\right)\tan^2\left(5n^2s\right)$$

195.

$$\frac{w\left(8w^5-2w^2+3w\left(t^3-6\right)+24\right)}{6}$$

196.

$$4bv^2\cdot\left(\frac{49\sin\left(14b^2v^2\right)}{2}+\frac{54\cot\left(6b^2v^2\right)}{\sin^2\left(6b^2v^2\right)}\right)$$

197.

$$r^2\cdot\left(18r^3-50r^2t^4+12t^3+3t\right)$$

198.

$$-45u^2x^4+48ux^5-2$$

199.

$$10e^{6z}\left(7r^2\cot\left(7r^2z\right)-6\log\left(e\right)\right)\csc\left(7r^2z\right)$$

200.

$$C+\sqrt[3]{9-2n}$$