# *Precalculus with Limits 6th edition Larson Solutions Manual*

SKU: 9798214407760-SOLUTIONS

# Solution and Answer Guide

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APPENDIX A: REVIEW OF FUNDAMENTAL CONCEPTS OF ALGEBRA

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## Appendix A.1 Real Numbers and Their Properties

**A.1.1.**

irrational

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Origin

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terms

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Zero-Factor Property

**A.1.5.**

Yes. $|3-10|=|-7|=7$ and $|10-3|=|7|=7$.

**A.1.6.**

(a) iii
(b) iv
(c) ii
(d) v
(e) i

**A.1.7.**

$-9, -\frac{7}{2}, 5, \frac{2}{3}, \sqrt{3}, 0, 3, -4, 2, -11$

(a) Natural numbers: 5, 8, 2
(b) Whole numbers: 5, 0, 8, 2
(c) Integers: $-9, 5, 0, 8, -4, 2, -11$
(d) Rational numbers: $-9, -\frac{7}{2}, 5, \frac{2}{3}, 0, 8, -4, 2, -11$
(e) Irrational numbers: $\sqrt{3}$

**A.1.8.**

$\sqrt{5}, -7, -\frac{7}{3}, 0, 3.14, \frac{5}{4}, -3, 12, 5$

(a) Natural numbers: 12, 5
(b) Whole numbers: 0, 12, 5
(c) Integers: $-7, 0, -3, 12, 5$
(d) Rational numbers: $-7, -\frac{7}{3}, 0, 3.14, \frac{5}{4}, -3, 12, 5$
(e) Irrational numbers: $\sqrt{5}$

**A.1.9.**

$2.01, 0.\overline{6}, -13, 0.010110111\ldots, 1, -6$

(a) Natural numbers: 1

(b) Whole numbers: 1

(c) Integers: $-13, \ 1, \ -6$

(d) Rational numbers: $2.01, 0.\overline{6}, -13, 1, -6$

(e) Irrational numbers: $0.010110111\ldots$

**A.1.10.**

$25, \ -17, \ -\frac{12}{5}, \ \sqrt{9}, \ 3.12, \ \frac{1}{2}\pi, \ 18, \ -11.1, \ 13$

(a) Natural numbers: $25, \ \sqrt{9} = 3, \ 18, \ 13$

(b) Whole numbers: $25, \ \sqrt{9} = 3, \ 18, \ 13$

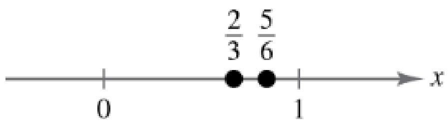
(c) Integers: $25, \ -17, \ \sqrt{9} = 3, \ 18, \ 13$

(d) Rational numbers: $25, \ -17, \ -\frac{12}{5}, \ \sqrt{9} = 3, \ 3.12, \ 18, \ -11.1, \ 13$

(e) Irrational numbers: $\frac{1}{2}\pi$

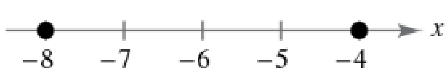
**A.1.11.**

$\frac{5}{6} > \frac{2}{3}$



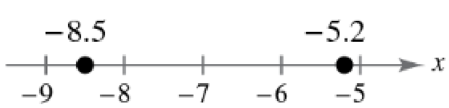

**A.1.12.**

$-4 > -8$



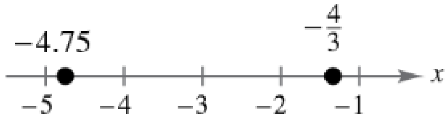

**A.1.13.**

$-5.2 > -8.5$



**A.1.14.**

$-\frac{4}{3} > -4.75$




**A.1.15.**

The inequality $x \le 5$ denotes the set of all real numbers less than or equal to 5.

**A.1.16.**

The inequality $x < 0$ denotes the set of all real numbers less than zero.

**A.1.17.**

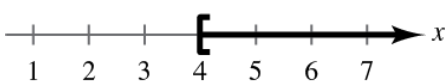
The inequality $-2 < x < 2$ denotes the set of all real numbers greater than $-2$ and less than 2.

**A.1.18.**

The inequality $0 < x \le 6$ denotes the set of all positive real numbers less than or equal to 6.

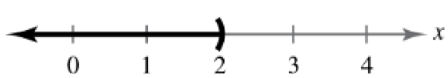
**A.1.19.**

The interval $\left[4, \infty\right)$ denotes the set of all real numbers greater than or equal to 4; $x \ge 4$.



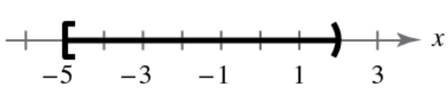

**A.1.20.**

The interval $\left(-\infty, 2\right)$ denotes the set of all real numbers less than 2; $x < 2$.



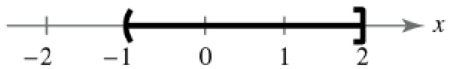

**A.1.21.**

The interval $\left[-5, 2\right)$ denotes the set of all real numbers greater than or equal to $-5$ and less than 2; $-5 \le x < 2$.



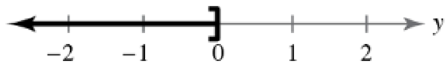
**A.1.22.**

The interval $(-1, 2]$ denotes the set of all real numbers greater than $-1$ and less than or equal to 2; $-1 < x \le 2$.



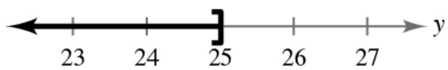

**A.1.23.**

$(-\infty, 0]$; $y \le 0$



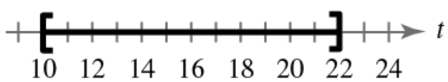

**A.1.24.**

$(-\infty, 25]$; $y \le 25$



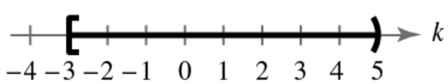

**A.1.25.**

$[10, 22]$; $10 \le t \le 22$




**A.1.26.**

$[-3, 5)$; $-3 \le k < 5$




**A.1.27.**

$|-10| = -(-10) = 10$

**A.1.28.**

$|0| = 0$

**A.1.29.**

$|-1| - |-2| = 1 - 2 = -1$

**A.1.30.**

$$-3-\left|-3\right|=-3-\left(3\right)=-6$$

**A.1.31.**

$$5\ \left|-5\right|=5\left(5\right)=25$$

**A.1.32.**

$$-4\ \left|-4\right|=-4\left(4\right)=-16$$

**A.1.33.**

If $x<-2$, then $x+2$ is negative.

So, $\dfrac{\left|x+2\right|}{x+2}=\dfrac{-\left(x+2\right)}{x+2}=-1.$

**A.1.34.**

If $x>1$, then $x-1$ is positive.

So, $\dfrac{\left|x-1\right|}{x-1}=\dfrac{x-1}{x-1}=1.$

**A.1.35.**

$\left|-4\right|=\left|4\right|$ because $\left|-4\right|=4$ and $\left|4\right|=4.$

**A.1.36.**

$-5=-\ \left|5\right|$ because $-5=-5.$

**A.1.37.**

$-\left|-6\right|<\left|-6\right|$ because $\left|-6\right|=6$ and $-\left|-6\right|=-\left(6\right)=-6.$

**A.1.38.**

$-\left|-2\right|=-\ \left|2\right|$ because $-2=-2.$

**A.1.39.**

$$d\left(126,\ 75\right)=\left|75-126\right|=51$$

**A.1.40.**

$$d\left(-20,\ 30\right)=\left|30-\left(-20\right)\right|=\left|50\right|=50$$

**A.1.41.**

$$d\left(-\tfrac{5}{2}, 0\right) = \left|0 - \left(-\tfrac{5}{2}\right)\right| = \tfrac{5}{2}$$

**A.1.42.**

$$d\left(-\tfrac{1}{4}, -\tfrac{11}{4}\right) = \left|-\tfrac{11}{4} - \left(-\tfrac{1}{4}\right)\right| = \left|-\tfrac{5}{2}\right| = \tfrac{5}{2}$$

**A.1.43.**

$7x + 4$
Terms: $7x,\ 4$
Coefficient: 7

**A.1.44.**

$6x^3 - 5x$
Terms: $6x^3,\ -5x$
Coefficients: $6,\ -5$

**A.1.45.**

$4x^3 + 0.5x - 5$
Terms: $4x^3,\ 0.5x,\ -5$
Coefficients: $4,\ 0.5$

**A.1.46.**

$3\sqrt{3}x^2 + 1$
Terms: $3\sqrt{3}x^2,\ 1$
Coefficient: $3\sqrt{3}$

**A.1.47.**

Receipts: $R$ = \$3268.0 billion
Expenditures: $E$ = \$3852.6 billion
$|R - E| = |3268.0 - 3852.6| = |-584.6| = \$584.6$ billion

**A.1.48.**

Receipts: $R$ = \$3329.9 billion
Expenditures: $E$ = \$4109.0 billion
$|R - E| = |3329.9 - 4109.0| = |-779.1| = \$779.1$ billion

**A.1.49.**

Receipts: $R$ = \$3421.2 billion
Expenditures: $E$ = \$6553.6 billion
$|R - E| = |3421.2 - 6553.6| = |-3132.4| = \$3132.4$ billion

**A.1.50.**

Receipts: $R$ = \$4897.3 billion
Expenditures: $E$ = \$6273.3 billion
$|R-E| = |4897.3-6273.3| = |-1376.0| = \$1376.0$ billion

**A.1.51.**

$x^2 - 3x + 2$

(a) $(0)^2 - 3(0) + 2 = 2$

(b) $(-1)^2 - 3(-1) + 2 = 1 + 3 + 2 = 6$

**A.1.52.**

$\dfrac{x-2}{x+2}$

(a) $\dfrac{2-2}{2+2} = \dfrac{0}{4} = 0$

(b) $\dfrac{-2-2}{-2+2} = \dfrac{-4}{0}$

Division by zero is undefined.

**A.1.53.**

$$\frac{2x}{3} - \frac{x}{4} = \frac{8x}{12} - \frac{3x}{12} = \frac{5x}{12}$$

**A.1.54.**

$$\frac{3x}{4} + \frac{x}{5} = \frac{15x}{20} + \frac{4x}{20} = \frac{19x}{20}$$

**A.1.55.**

$$\frac{3x}{10} \cdot \frac{5}{6} = \frac{x}{2} \cdot \frac{1}{2} = \frac{x}{4}$$

**A.1.56.**

$$\frac{2x}{3} \div \frac{6}{7} = \frac{2x}{3} \cdot \frac{7}{6} = \frac{x}{3} \cdot \frac{7}{3} = \frac{7x}{9}$$

**A.1.57.**

False. Because zero is nonnegative but not positive, not every nonnegative number is positive.

**A.1.58.**

The product of two negative numbers is positive.

**A.1.59.**

The distributive law was used incorrectly. The 5 was not distributed to the 3.

**A.1.60.**

(a) Because the price can only be a positive rational number with at most two decimal places, the description matches graph (ii).
A range of prices can only include zero and positive numbers with at most two decimal places. So, a range of prices can be represented by whole numbers and some noninteger positive fractions.

(b) Because the distance is a positive real number, the description matches graph (i).
A range of lengths can only include positive numbers. So, a range of lengths can be represented by positive real numbers.

**A.1.61.**

$5/n$ increases or decreases without bound. As $n$ approaches 0, $5/n$ increases when $n$ is positive and decreases when $n$ is negative.

**A.1.62.**

$5/n$ approaches 0 as $n$ increases without bound. As $n$ increases, $5/n$ decreases but stays positive.

**A.1.63.**

$6 = 2 \cdot 3,\ 8 = 2 \cdot 2 \cdot 2$

(a) Greatest common factor: 2

(b) Least common multiple: $2 \cdot 2 \cdot 2 \cdot 3 = 24$

**A.1.64.**

$10 = 2 \cdot 5,\ 25 = 5 \cdot 5$

(a) Greatest common factor: 5

(b) Least common multiple: $2 \cdot 5 \cdot 5 = 50$

**A.1.65.**

$27 = 3 \cdot 3 \cdot 3,\ 36 = 2 \cdot 2 \cdot 3 \cdot 3,\ 54 = 2 \cdot 3 \cdot 3 \cdot 3$

(a) Greatest common factor: $3 \cdot 3 = 9$

(b) Least common multiple: $2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 = 108$

**A.1.66.**

$49 = 7 \cdot 7,\ 98 = 2 \cdot 7 \cdot 7,\ 112 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 7$

(a) Greatest common factor: 7

(b) Least common multiple: $2 \cdot 2 \cdot 2 \cdot 2 \cdot 7 \cdot 7 = 784$

**A.1.67.**

$$-(3\cdot 3)=-9$$

**A.1.68.**

$$(-3)(-3)=3\cdot 3=9$$

**A.1.69.**

$$\frac{(-5)(-5)}{-5}=-5$$

**A.1.70.**

$$\frac{-(5\ \cdot\ 5)}{(-5)(-5)(-5)}=\frac{5\ \cdot\ 5}{5\ \cdot\ 5\ \cdot\ 5}=\frac{1}{5}$$

**A.1.71.**

$$48=2\cdot 2\cdot 2\cdot 2\cdot 3=2^4\cdot 3$$

**A.1.72.**

$$250=2\cdot 5\cdot 5\cdot 5=2\cdot 5^3$$

**A.1.73.**

$$792\ =\ 8\cdot 9\cdot 11\ =\ 2\cdot 2\cdot 2\cdot 3\cdot 3\cdot 11\ =\ 2^3\cdot 3^2\cdot 11$$

**A.1.74.**

$$4802=2\cdot 7\cdot 7\cdot 7\cdot 7=2\cdot 7^4$$

**A.1.75.**

$$3.785(10,000)=37,850$$

**A.1.76.**

$$1.42(1,000,000)=1,420,000$$

**A.1.77.**

$$\frac{6.09}{1000}=0.00609$$

**A.1.78.**

$$\frac{8.603}{100,000}=0.00008603$$

# Appendix A.2 Exponents and Radicals

**A.2.1.**

exponent; base

**A.2.2.**

index; radicand

**A.2.3.**

An expression involving radicals is in simplest form when the following conditions are satisfied:

1. All possible factors have been removed from the radical.
2. All fractions have radical-free denominators.
3. The index of the radical is reduced.

**A.2.4.**

64 is both a perfect square $\left(8^2 = 64\right)$ and a perfect cube $\left(4^3 = 64\right)$.

**A.2.5.**

$$5 \cdot 5^3 = 5^4 = 625$$

**A.2.6.**

$$\begin{aligned}\left(2^3 \cdot 3^2\right)^2 &= 2^{3\cdot 2} \cdot 3^{2\cdot 2}\\ &= 2^6 \cdot 3^4 = 64 \cdot 81 = 5184\end{aligned}$$

**A.2.7.**

$$\frac{5^2}{5^4} = 5^{-2} = \frac{1}{5^2} = \frac{1}{25}$$

**A.2.8.**

$$\begin{aligned}\left(-\frac{3}{5}\right)^3 \left(\frac{5}{3}\right)^2 &= \left(-1\right)^3 \frac{3^3}{5^3} \cdot \frac{5^2}{3^2} = -1 \cdot 3^{3-2} \cdot 5^{2-3}\\ &= -3 \cdot 5^{-1} = -\frac{3}{5}\end{aligned}$$

**A.2.9.**

$$-3^2 = -9$$

**A.2.10.**

$$\left(-4\right)^{-3} = \frac{1}{\left(-4\right)^3} = -\frac{1}{64}$$

**A.2.11.**

$$\frac{4 \cdot 3^{-2}}{2^{-2} \cdot 3^{-1}} = 4 \cdot 2^{2} \cdot 3^{-2-(-1)} = 4 \cdot 4 \cdot 3^{-1} = \frac{16}{3}$$

**A.2.12.**

$$\frac{3}{3^{-4}} = 3 \cdot 3^{4} = 3^{5} = 243$$

**A.2.13.**

When $x = 2$,

$$-3x^{3} = -3(2)^{3} = -24.$$

**A.2.14.**

When $x = 4$,

$$7x^{-2} = 7(4)^{-2} = \frac{7}{4^{2}} = \frac{7}{16}.$$

**A.2.15.**

When $x = 0.1$,

$$6x^{2} = 6(0.1)^{2} = 6(0.01) = 0.06.$$

**A.2.16.**

When $x = -\frac{1}{3}$,

$$12(-x)^{3} = 12\left(\tfrac{1}{3}\right)^{3} = 12\left(\tfrac{1}{27}\right) = \tfrac{4}{9}.$$

**A.2.17.**

$$6y^{2}\left(2y^{0}\right)^{2} = 6y^{2}(2 \cdot 1)^{2} = 6y^{2}(4) = 24y^{2}$$

**A.2.18.**

$$\begin{aligned}(-z)^{3}\left(3z^{4}\right) &= (-1)^{3}\left(z^{3}\right)3z^{4} \\ &= -1 \cdot 3 \cdot z^{3+4} = -3z^{7}\end{aligned}$$

**A.2.19.**

$$\frac{7x^{2}}{x^{3}} = 7x^{2-3} = 7x^{-1} = \frac{7}{x}$$