

Intro to Algebra

Arithmetic

Questions:

1) Calculate the following expressions:

a. $6+1$

b. $6-1$

c. $-6-1$

d. $-6+1$

e. $-5-13+9$

f. $5+7-23+1$

g. $5-8-12+17$

2) Calculate the following expressions:

a. $2 \cdot 5$

b. $-2 \cdot (-5)$

c. $-2 \cdot 5$

d. $2 \cdot (-5)$

e. $-2 \cdot 0$

f. $(-2) \cdot (-3) \cdot (-4)$

g. $(-2) \cdot 3 \cdot (-4)$

3) Calculate the following expressions:

a. $8:4$

b. $-50:-10$

c. $-15:3$

d. $(-25):(-5)$

e. $(-30):(3)$

f. $(0):(5)$

g. $\frac{32}{-4}$

4) Calculate the following expressions:

a. 2^2

b. 2^4

c. 2^6

d. -2^4

e. $(-2)^4$

f. (-2^4)

g. -2^3

5) Calculate the following expressions:

a. $\sqrt{64}$

b. $\sqrt[3]{64}$

c. $\sqrt[5]{32}$

d. $\sqrt{-16}$

e. $\sqrt[4]{64}$

f. $\sqrt[4]{-64}$

g. $-3^4 + \sqrt[3]{-8}$

h.

i.

6) Calculate the following expressions:

- | | | |
|--------------------|--------------------|--------------------|
| a. $\sqrt{169}$ | b. -4^2 | c. $(-3)^3$ |
| d. $\sqrt[3]{-27}$ | e. $\sqrt[4]{625}$ | f. $\sqrt[4]{-16}$ |
| g. $\sqrt[5]{-32}$ | h. | i. |

7) Calculate the following expressions:

- | | |
|---|--|
| a. $\sqrt{196} + 5 \cdot 2^2 - 20 : 2$ | b. $(-2)^4 : 2 - 10 \cdot (-2)^3$ |
| c. $-3^2 - 4[5 + 4 \cdot (7 - 2)] + \sqrt{900}$ | d. $\sqrt{64} : (-4 + 2) - 4^2 \cdot (-3^2 + 10)$ |
| e. $\sqrt{144} - 20 : 4 + 3 \cdot (-2)^2$ | f. $3 + 4 \cdot [-3 + 4 \cdot (-2)] + \sqrt{10 + 6}$ |
| g. $(-3)^4 : (-9) - 5 \cdot (-2)^3$ | |

Answer Key:

- | | | | |
|----------|-----------------|--------|-----------------|
| 1) a. 7 | b. 5 | c. -7 | d. -5 |
| e. -9 | f. -10 | g. 2 | |
| 2) a. 10 | b. 10 | c. -10 | d. -10 |
| e. 0 | f. -24 | g. 24 | |
| 3) a. 2 | b. 5 | c. -5 | d. 5 |
| e. -10 | f. 0 | g. -8 | |
| 4) a. 4 | b. 16 | c. 64 | d. -16 |
| e. 16 | f. -16 | g. -8 | |
| 5) a. 8 | b. 4 | c. 2 | d. No solution. |
| e. 2.828 | f. No solution. | g. -83 | |
| 6) a. 13 | b. -16 | c. -27 | d. -3 |
| e. 5 | f. No solution. | g. -2 | |
| 7) a. 24 | b. 88 | c. -79 | d. -20 |
| e. 19 | f. -37 | g. 31 | |

Fractions

Questions:

1) Write the following improper fractions as mixed numbers:

a. $\frac{3}{2}$ b. $\frac{8}{5}$ c. $\frac{13}{2}$ d. $\frac{18}{4}$

2) Write the following mixed numbers as improper fractions:

a. $2\frac{3}{8}$ b. $12\frac{2}{5}$ c. $6\frac{1}{2}$ d. $8\frac{1}{4}$

3) Which fraction is bigger?

a. $\frac{5}{7}$ or $\frac{3}{7}$ b. $\frac{3}{5}$ or $\frac{3}{7}$ c. $\frac{3}{4}$ or $\frac{4}{5}$

4) Convert the following decimals to fractions:

a. 0.3 b. 0.02 c. 1.012 d. 2.75

5) Convert the following fractions to decimals:

a. $\frac{1}{10}$ b. $\frac{1}{100}$ c. $\frac{3}{1000}$ d. $\frac{12}{1000}$

6) Convert the following fractions to decimals:

a. $1\frac{12}{1000}$ b. $\frac{3}{50}$ c. $\frac{7}{20}$ d. $\frac{12}{25}$

7) Convert the following percentages to fractions:

a. 50% b. 25% c. 75% d. 15%

8) Convert the following fractions to percentages:

a. $\frac{4}{10}$ b. $\frac{5}{20}$

9) Calculate the following expressions:

a. $\frac{1}{4} + \frac{3}{4}$

b. $\frac{5}{2} + \frac{7}{4}$

c. $\frac{3}{2} + \frac{1}{4} - \frac{5}{8}$

d. $\frac{2}{3} + \frac{5}{9} - \frac{1}{6}$

10) Calculate the following expressions:

a. $\frac{3}{4} - \frac{5}{6} + \frac{7}{5}$

b. $1\frac{1}{8} - \frac{11}{12}$

c. $1\frac{1}{9} - \frac{23}{27} + 2$

d. $1\frac{2}{21} - \frac{3}{14} - 3$

11) Calculate the following expressions:

a. $\frac{2}{3} \cdot \frac{2}{5}$

b. $4 \cdot \frac{2}{5}$

c. $2\frac{1}{3} \cdot 1\frac{1}{4}$

d. $3\frac{1}{3} \cdot 2\frac{2}{5}$

12) Calculate the following expressions:

a. $\frac{2}{3} : \frac{5}{6}$

b. $\frac{2}{5} : 4$

c. $6 : \frac{3}{4}$

d. $2\frac{2}{3} : 1\frac{1}{5}$

13) Calculate the following expressions:

a. $\frac{5}{9} : 3\frac{1}{3}$

b. $\left(\frac{3}{4}\right)^3$

c. $\frac{3^3}{4}$

d. $\frac{9}{20} \cdot 1\frac{1}{3} + 1\frac{1}{4} : \frac{1}{2}$

14) Calculate the following expressions:

a. $\frac{4}{3} \cdot \frac{2}{7}$

b. $5\frac{1}{3} : \frac{1}{6}$

c. $\frac{6}{2} \cdot \frac{2}{3} \cdot \frac{9}{4}$

d. $3\frac{1}{2} \cdot 4\frac{2}{5}$

15) Calculate the following expressions:

a. $\frac{5}{6} : 3$

b. $3\frac{3}{4} : 5\frac{5}{8}$

c. $8 \cdot \frac{3}{2} : \frac{12}{20}$

Answer Key:

- | | | | |
|-------------------------|--------------------|---------------------|---------------------|
| 1) a. $1\frac{1}{2}$ | b. $1\frac{3}{5}$ | c. $6\frac{1}{2}$ | d. $4\frac{1}{2}$ |
| 2) a. $\frac{19}{8}$ | b. $\frac{62}{5}$ | c. $\frac{13}{2}$ | d. $\frac{33}{4}$ |
| 3) a. $\frac{5}{7}$ | b. $\frac{3}{5}$ | c. $\frac{4}{5}$ | |
| 4) a. $\frac{3}{10}$ | b. $\frac{1}{50}$ | c. $1\frac{3}{250}$ | d. $2\frac{3}{4}$ |
| 5) a. 0.1 | b. 0.01 | c. 0.003 | d. 0.012 |
| 6) a. 1.012 | b. 0.06 | c. 0.35 | d. 0.48 |
| 7) a. $\frac{1}{2}$ | b. $\frac{1}{4}$ | c. $\frac{3}{4}$ | d. $\frac{3}{20}$ |
| 8) a. 40% | b. 25% | | |
| 9) a. 1 | b. $4\frac{1}{4}$ | c. $1\frac{1}{8}$ | d. $1\frac{1}{18}$ |
| 10) a. $1\frac{19}{60}$ | b. $\frac{5}{24}$ | c. $2\frac{7}{27}$ | d. $-2\frac{6}{42}$ |
| 11) a. $\frac{4}{15}$ | b. $1\frac{3}{5}$ | c. $2\frac{11}{12}$ | d. 8 |
| 12) a. $\frac{4}{5}$ | b. $\frac{1}{10}$ | c. 8 | d. $2\frac{2}{9}$ |
| 13) a. $\frac{1}{6}$ | b. $\frac{27}{64}$ | c. $6\frac{3}{4}$ | d. $3\frac{1}{10}$ |
| 14) a. $\frac{8}{21}$ | b. 32 | c. $1\frac{4}{5}$ | d. $15\frac{2}{5}$ |
| 15) a. $\frac{5}{18}$ | b. $\frac{2}{3}$ | c. 20 | |

Algebraic Expressions

Questions:

1) Evaluate the following algebraic expressions using substitution:

a. $(x + y)^3$, $x = 5$, $y = -4$

b. $a^5 - 3a^4 - a^3 + 7$, $a = -1$

c. $16m^2 - 9n^2$, $m = \frac{1}{2}$, $n = -\frac{1}{3}$

d. $\frac{4a^2 - 3b}{c}$, $a = -1$, $b = 2$, $c = -4$

2) Evaluate the following algebraic expressions using substitution:

a. $\frac{(a - 2c)^4}{a} - a^2$, $a = 2$, $c = -2$

b. $a^2 + 2ab + b^2$, $a = 3$, $b = -5$

c. $(x - 3)^2 + 3x^2b$, $x = 5$, $b = -1$

d. $-x^3 - 2xy + y^4$, $x = -2$, $y = -1$

3) Combine [collect] like terms:

a. $5x + 3x - 12x$

b. $a^5 + a^5$

c. $7m + 11 - 9m - 2$

d. $1 + b^2 - 2b - 3 - 2b^2$

4) Evaluate the following algebraic expressions using substitution:

a. $4ab - 3a^2b + 3b^2a - 5ab$

b. $x^2y - xy + 3y^2x + 9xy - 5xy^2$

c. $10m^2n - \{3mn^2 - [m^2n - 2m]5\}$

d. $8a^2 + 10a - 5a^2 - 11a + a^2$

e. $5a^2b - 8ab^2 + 20a^2b - 14ab^2$

5) Expand the brackets:

a. $2(x + 4)$

b. $x(x + 5)$

c. $7(a - 3)$

d. $-2(b - 2x)$

6) Expand the brackets:

a. $x(x^2 + 3x - 2)$

b. $\frac{2}{3}(6x - 3y)$

c. $-(5y - 7)$

d. $(3x + 2y)5$

7) Expand the brackets:

a. $-3x(2x - y)$

b. $x + 5(2x - 1)$

c. $(x + 4)(x + 5)$

d. $(x + 3)(5 - x)$

8) Expand the brackets:

a. $3(x-1)(x-3)$

b. $(2x-5)(2x+5)$

c. $4(3x-2)-(2x-1)(3x+5)$

d. $a(a-2b+c)$

Answer Key:

- | | | | |
|-------------------------|---------------------|-----------------------|------------------|
| 1) a. 1 | b. 4 | c. 3 | d. $\frac{1}{2}$ |
| 2) a. 644 | b. 4 | c. -71 | d. 5 |
| 3) a. $-4x$ | b. $2a^2$ | c. $-2m+9$ | d. $-b^2-2b-2$ |
| 4) a. $-ab-3a^2b+3b^2a$ | b. $x^2y+8xy-2xy^2$ | c. $15m^2n-3mn^2-10m$ | |
| d. $4a^2-a$ | e. $25a^2b-22ab^2$ | | |
| 5) a. $2x+8$ | b. x^2+5x | c. $7a-21$ | d. $-2b+4x$ |
| 6) a. x^3+3x^2-2x | b. $4x-2y$ | c. $-5y+7$ | d. $15x+10y$ |
| 7) a. $-6x^2+3xy$ | b. $11x-5$ | c. $x^2+9x+20$ | d. $-x^2+2x+15$ |
| 8) a. $3x^2-12x+9$ | b. $4x^2-25$ | c. $-6x^2+5x-3$ | d. $a^2-2ab+ac$ |

Special Binomial Products

Questions:

1) Expand the following Square Binomials:

a. $(x+2)^2$ b. $(a+3)^2$ c. $(b+1)^2$ d. $\left(c+\frac{1}{4}\right)^2$

2) Expand the following Square Binomials:

a. $(2m+5)^2$ b. $(5y+4t)^2$ c. $(x^2y+11)^2$

3) Expand each of the following as a Difference of Squares:

a. $(x-7)(x+7)$ b. $(9-x)(9+x)$ c. $(3x-4)(3x+4)$

4) Simplify the following by taking out a Common Factor.

a. $2x-4$ b. $3x-6$ c. $80-4x$ d. $64+8a$

5) Simplify the following by taking out a Common Factor:

a. x^2+3x b. x^3-x c. x^5-2x^2 d. $4x^3+12x^2$

6) Factorize the following as Square Binomials:

a. x^2+6x+9 b. $9a^2+12a+4$
c. $12x^2+60x+75$ d. $x^2-16x+64$

7) Factorize the following as Special Binomial Products:

[Difference of Squares or Square Binomials]

a. $a^2-10a+25$ b. $2x^2-36x+162$
c. x^2-16 d. a^2-9

8) Simply the following by using Special Binomial Products:

[Difference of Squares or Square Binomials]

a. $81-x^2$ b. $100x^2-49$ c. $49x-x^3$
d. x^3-x e. m^2-9

Answer Key:

- 1) a. $x^2 + 4x + 4$ b. $a^2 + 6a + 9$ c. $b^2 + 2b + 1$
d. $c^2 + \frac{1}{2}c + \frac{1}{16}$
- 2) a. $4m^2 + 20m + 25$ b. $25y^2 + 40yt + 16t^2$ c. $x^4y^2 + 22x^2y + 121$
- 3) a. $x^2 - 49$ b. $81 - x^2$ c. $9x^2 - 16$
- 4) a. $2(x - 2)$ b. $3(x - 2)$ c. $4(20 - x)$
d. $8(8 + a)$
- 5) a. $x(x + 3)$ b. $x(x^2 - 1)$ c. $x^2(x^3 - 2)$
d. $4x^2(x + 3)$
- 6) a. $(x + 3)^2$ b. $(3a + 2)^2$ c. $3(2x + 5)^2$
d. $(x - 8)^2$
- 7) a. $(a - 5)^2$ b. $2(x - 9)^2$ c. $(a + 3)(a - 3)$
d. $(x + 4)(x - 4)$
- 8) a. $(9 + x)(9 - x)$ b. $(10x + 7)(10x - 7)$ c. $x(7 + x)(7 - x)$
d. $x(x + 1)(x - 1)$ e. $(m + 3)(m - 3)$

Rational Expressions

Questions:

1) In problems a-c, reduce the rational expressions to lowest terms:

a. $\frac{x^2 + 4x}{2x^2 - 5x}$

b. $\frac{x-1}{x^2 + 2x - 3}$

c. $\frac{x^2 - 2x - 8}{x^2 - 4}$

2) In problems a-d perform the indicated operation and reduce the answer to lowest terms:

a. $\frac{x^2 + x - 2}{x^2 - x - 6} \cdot \frac{x^2 + 2x - 15}{x^2 + 3x - 4}$

b. $\frac{x^2 - 9}{x^2 + 4x - 21} \div \frac{x^2 + 6x - 27}{x^2 + 14x + 45}$

c. $\frac{x^2 - 4x + 3}{x^2 + 4x - 5} \div \frac{x^2 + 6x - 27}{x^2 + 14x + 45}$

d. $\frac{\frac{3}{x^2 - 4}}{x + 5}$
 $\frac{\quad}{x^2 + 8x - 20}$

Answer Key:

1) a. $\frac{x+4}{2x-5}$

b. $\frac{1}{x+3}$

c. $\frac{x-4}{x-2}$

2) a. $\frac{x+5}{x+4}$

b. $\frac{x+2}{x-1}$

c. 1

d. $\frac{3(x+10)}{(x+2)(x+5)}$

Complex Numbers

Questions:

1) Evaluate each of the following and write your answers in standard form:

a. $(4+i)+(3-2i)$ b. $(-2+3i)-(4-5i)$ c. $3(2+i)-5(6+2i)$
d. $i(4+i)+3i(-5+2i)$ e. $2i(3+i)+4(2-3i)$

2) Perform the following multiplications and write your answers in standard form:

a. $(4+i)\cdot(3-2i)$ b. $(-2+3i)\cdot(4-5i)$ c. $(-4-2i)\cdot(-2+3i)$
d. $(2-4i)\cdot(1-3i)$ e. $(4-2i)\cdot(4+2i)$

3) Compute the following powers [exponents] and write your answer in standard form:

a. i^8 b. i^{15} c. $(-i)^6$ d. $(-i)^9$
e. $(2i+3)^2$ f. $(i^5-i^{13})^2$

4) Perform the following divisions and write your answers in standard form:

a. $\frac{5}{2+i}$ b. $\frac{2+3i}{5-2i}$ c. $\frac{6-i}{-4i}$ d. $\frac{4+2i}{4-2i}$
e. $\frac{1-2i}{(2i+3)^2}$

5) Write with i , ($i = \sqrt{-1}$):

a. $\sqrt{-4}$ b. $\sqrt{-9}$ c. $\sqrt{-5}$

6) Solve the following equations:

a. $x^2+36=0$ b. $x^2-2x+5=0$ c. $t^2-4t+5=0$
d. $4z^2+12z+25=0$ e. $4z^2+16z+25=0$ f. $(1+i)z^2+2z+1-i=0$

Answer Key:

- 1) a. $7 - i$ b. $-6 + 8i$ c. $-24 - 7i$ d. $-7 - 11i$
e. $6 - 6i$
- 2) 1. $14 - 5i$ b. $7 + 22i$ c. $14 - 8i$ d. $-10 - 10i$
e. 20
- 3) a. 1 b. $-i$ c. -1 d. $-i$
e. $5 + 12i$ f. 0
- 4) a. $2 - i$ b. $\frac{4}{29} + \frac{19}{29}i$ c. $\frac{1}{4} + \frac{3}{2}i$ d. $\frac{3}{5} + \frac{4}{5}i$
e. $-\frac{19}{169} - \frac{22}{169}i$
- 5) a. $2i$ b. $3i$ c. $\sqrt{5} \cdot i$
- 6) a. $\pm 6i$ b. $1 \pm 2i$ c. $2 \pm i$ d. $-\frac{3}{2} \pm 2i$
e. $-2 \pm \frac{3}{2}i$ f. $i, -1$