

# Preliminaries

## Arithmetic

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### 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.  $\sqrt[3]{32}$

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

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### 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.  $\frac{5}{20}$

## College Algebra 2

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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. $a^2-2ab+ac$  |

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**Special Binomial Products**

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**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.  $(m + 3)(m - 3)$

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**Rational Expressions**

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

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

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**Complex Numbers**

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**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.  $i, -1$