



Student Success Center

College Level Math Study Guide for the
ACCUPLACER (CPT)

I. Factoring and expanding polynomials

Factor the following polynomials:

- $15a^3b^2 - 45a^2b^3 - 60a^2b$
- $7x^3y^3 + 21x^2y^2 - 10x^3y^2 - 30x^2y$
- $6x^4y^4 - 6x^3y^2 + 8xy^2 - 8$
- $2x^2 - 7xy + 6y^2$
- $y^4 + y^2 - 6$
- $7x^3 + 56y^3$
- $81r^4 - 16s^4$
- $(x + y)^2 + 2(x + y) + 1$

Expand the following:

- $(x + 1)(x - 1)(x - 3)$
- $(2x + 3y)^2$
- $(\sqrt{3}x + \sqrt{3})(\sqrt{6}x - \sqrt{6})$
- $(x^2 - 2x + 3)^2$
- $(x + 1)^5$
- $(x - 1)^6$

II. Simplification of Rational Algebraic Expressions

Simplify the following. Assume all variables are larger than zero.

- $3^2 + 5 - \sqrt{4} + 4^0$
- $9 \div 3 \cdot 5 - 8 \div 2 + 27$
- $\sqrt{\frac{81}{x^4}}$
- $2\sqrt{18} - 5\sqrt{32} + 7\sqrt{162}$
- $\frac{6x - 18}{3x^2 + 2x - 8} \cdot \frac{12x - 16}{4x - 12}$
- $9 \div 3 \cdot 5 - 8 \div 2 + 27$
- $\sqrt{\frac{81}{x^4}}$
- $2\sqrt{18} - 5\sqrt{32} + 7\sqrt{162}$
- $\frac{6x - 18}{3x^2 + 2x - 8} \cdot \frac{12x - 16}{4x - 12}$

III. Solving Equations

A. Linear

- $3 - 2(x - 1) = x - 10$
- $\frac{x}{2} - \frac{x}{7} = 1$
- $y(y + 2) = y^2 - 6$
- $2[x - (1 - 3x)] = 3(x + 1)$

B. Quadratic & Polynomial

- $\left(y - \frac{8}{3}\right)\left(y + \frac{2}{3}\right) = 0$
- $2x^3 - 4x^2 - 30x = 0$
- $27^3 = 1$
- $(x - 3)(x + 6) = 9x + 22$
- $t^2 + t + 1 = 0$
- $3x^3 = 24$
- $(x + 1)^2 + x^2 = 25$
- $5y^2 - y = 1$

C. Rational

- $\frac{1}{y - 1} + \frac{2}{y + 1} = 0$
- $\frac{11}{x^2 - 25} - \frac{2}{x - 5} = \frac{1}{x + 5}$

$$2. \frac{2}{x-3} - \frac{3}{x+3} = \frac{12}{x^2-9}$$

$$3. \frac{1}{6-x} + \frac{2}{x+3} = \frac{5x}{x^2-3x-18}$$

$$5. \frac{1}{a} = \frac{-6}{a^2+5}$$

$$6. \frac{-1}{x^2-3x} = \frac{1}{x} + \frac{x}{x-3}$$

D. Absolute value

$$1. |5-2z|-1=8$$

$$2. |x+5|-7=-2$$

$$3. |5x-1|=-2$$

$$4. \left| \frac{1}{2}x - \frac{3}{4} \right| = \frac{1}{4}$$

$$5. |y-1|=|7+y|$$

E. Exponential

$$1. 10^x = 1000$$

$$2. 10^{3x+5} = 100$$

$$3. 2^{x+1} = \frac{1}{8}$$

$$4. 3^{x^2}(9^x) = \frac{1}{3}$$

$$5. 2^{x^2}(4^{2x}) = \frac{1}{8}$$

F. Logarithmic

$$1. \log_2(x+5) = \log_2(1-5x)$$

$$2. 2\log_3(x+1) = \log_3(4x)$$

$$3. \log_2(x+1) + \log_2(x-1) = 3$$

$$4. \ln x + \ln(2x+1) = 0$$

$$5. \ln x + \ln(x+2) = \ln 3$$

$$6. 3^{2x} = 4^{x+1}$$

G. Radicals

$$1. 4\sqrt{2y-1}-2=0$$

$$2. \sqrt{2x+1}+5=8$$

$$3. \sqrt{5x-1}-2\sqrt{x+1}=0$$

$$4. \sqrt{x^2+9}+x+1=0$$

$$5. \sqrt[3]{3x+2}+4=6$$

$$6. \sqrt[4]{w^2+7}=2$$

IV. Solving Inequalities

Solve the following inequalities and express the answer graphically and using interval notation.

A. Linear

$$1. \frac{3}{5}x + 4 \leq -2$$

$$2. 3(x+3) \geq 5(x-1)$$

$$3. 3(x+2) - 6 > -2(x-3) + 14$$

$$4. 2 \leq 3x - 10 \leq 5$$

B. Absolute value: Solve and Graph.

1. $|4x + 1| \leq 6$

2. $|4x + 3| + 2 > 9$

3. $\left| \frac{x + 5}{3} \right| \geq 5$

4. $|5 - 2x| < 15$

C. Quadratic or Rational

1. $3x^2 - 11x - 4 < 0$

2. $6x^2 + 5x \geq 4$

3. $\frac{x + 2}{3 - x} \geq 0$

4. $\frac{(x + 1)(x - 3)}{2x + 7} \leq 0$

V. Lines & RegionsI. Find the x and y-intercepts, the slope, and graph $6x + 5y = 30$.II. Find the x and y-intercepts, the slope, and graph $x = 3$.III. Find the x and y-intercepts, the slope, and graph $y = -4$.

IV. Write in slope-intercept form the line that passes through the points (4, 6) and (-4, 2).

V. Write in slope-intercept form the line perpendicular to the graph of $4x - y = -1$ and containing the point (2, 3).VI. Graph the solution set of $x - y \geq 2$.VII. Graph the solution set of $-x + 3y < -6$.**VI. Graphing Relations, Domain & Range**

For each relation, state if it is a function, state the domain & range, and graph it.

1. $y = \sqrt{x + 2}$

6. $x = y^2 + 2$

2. $y = \sqrt{x} - 2$

7. $y = x^2 + 8x - 6$

3. $y = \frac{x - 1}{x + 2}$

8. $y = \sqrt{-x}$

4. $f(x) = -|x + 1| + 3$

9. $y = 3^x$

5. $f(x) = \frac{2x - 5}{x^2 - 9}$

10. $h(x) = \frac{6x^2}{3x^2 - 2x - 1}$

VII. Exponents and RadicalsSimplify. Assume all variables are > 0 . Rationalize the denominators when needed.

1. $\sqrt[3]{-8x^3}$

2. $5\sqrt{147} - 4\sqrt{48}$

3. $\sqrt{5}(\sqrt{15} - \sqrt{3})$

4. $\left(\frac{x^{\frac{2}{3}} y^{-\frac{4}{3}}}{x^{-\frac{5}{3}}} \right)^3$

5. $\sqrt[3]{\frac{40x^4}{y^9}}$

6. $\left(\frac{54a^{-6}b^2}{9a^{-3}b^8} \right)^{-2}$

7. $\frac{\sqrt[3]{27a^3}}{\sqrt[3]{2a^2b^2}}$

8. $\frac{2}{\sqrt{5} - \sqrt{3}}$

9. $\frac{x}{\sqrt{x} + 3}$

VIII. Complex Numbers

Perform the indicated operation and simplify.

1. $\sqrt{-16} - 4\sqrt{-9}$

2. $\sqrt{-16} \cdot \sqrt{-9}$

3. $\frac{\sqrt{-16}}{\sqrt{-9}}$

4. $(4 - 3i)(4 + 3i)$

5. $(4 - 3i)^2$

6. i^{25}

7. $\frac{3 - 2i}{4 + 5i}$

IX. Exponential Functions and Logarithms

1. Graph: $f(x) = 3^x + 1$

2. Graph: $g(x) = 2^{x-1}$

8. Express $8^{-2} = \frac{1}{64}$ in logarithmic form.

9. Express $\log_5 25 = 2$ in exponential form.

10. Solve: $2^{x+1} = \frac{1}{16}$

11. Solve: $9^x = \frac{1}{27}$

6. Solve: $\log_2 x = 4$

7. Solve: $\log_x 9 = 2$

VIII. Graph: $h(x) = \log_3 x$

IX. Use the properties of logarithms to expand as much as possible: $\log_4 \frac{3}{y}$

X. How long will it take \$850 to be worth \$1,000 if it is invested at 12% interest compounded quarterly.

XI. Systems of Equations & Matrices

1. Solve the system:
$$\begin{aligned} 2x + 3y &= 7 \\ 6x - y &= 1 \\ x + 2y + 2z &= 3 \end{aligned}$$

2. Solve the system:
$$\begin{aligned} 2x + 3y + 6z &= 2 \\ -x + y + z &= 0 \end{aligned}$$

3. Perform the indicated operation:

$$-2 \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix} + 3 \begin{bmatrix} \frac{1}{3} & -2 \\ 1 & 6 \end{bmatrix}$$

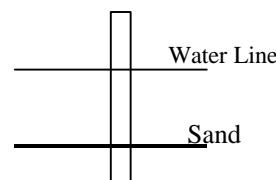
4. Multiply:
$$\begin{bmatrix} 1 & -1 & 1 \\ 0 & 2 & 0 \\ -2 & 1 & -3 \end{bmatrix} \begin{bmatrix} 0 & 2 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

5. Find the determinant:
$$\begin{vmatrix} 1 & -2 \\ 3 & -1 \end{vmatrix}$$

6. Find the Inverse:
$$\begin{bmatrix} 1 & 2 \\ -1 & 2 \end{bmatrix}$$

X. Story Problems

- Sam made \$10 more than twice what Pete earned in one month. If together they earned \$760, how much did each earn that month?
- A woman burns up three times as many calories running as she does when walking the same distance. If she runs 2 miles and walks 5 miles to burn up a total of 770 calories, how many calories does she burn up while running 1 mile?
- A pole is standing in a small lake. If one-sixth of the length of the pole is in the sand at the bottom of the lake, 25 ft are in the water, and two-thirds of the total length is in the air above the water, what is the length of the pole?



XII. Conic Sections

- Graph the following, and find the center, foci, and asymptotes if possible.
 - $(x-2)^2 + y^2 = 16$
 - $\frac{(x+1)^2}{16} + \frac{(y-2)^2}{9} = 1$
 - $\frac{(x+1)^2}{16} - \frac{(y-2)^2}{9} = 1$
 - $(x-2)^2 + y = 4$
- Identify the conic section and put into standard form.
 - $x^2 - 4x - 12 + y^2 = 0$
 - $9x^2 + 18x + 16y^2 - 64y = 71$
 - $9x^2 + 18x - 16y^2 + 64y = 199$
 - $x^2 + y - 4x = 0$

XIII. Sequence & Series

- Write out the first four terms of the sequence whose general term is $a_n = 3n - 2$.
- Write out the first four terms of the sequence whose general term is $a_n = n^2 - 1$.
- Write out the first four terms of the sequence whose general term is $a_n = 2^n + 1$.
- Find the general term for the following sequence: 2, 5, 8, 11, 14, 17, ...
- Find the general term for the following sequence: 4, 2, 1, $\frac{1}{2}$, $\frac{1}{4}$, ...
- Find the sum: $\sum_{k=0}^6 2k - 1$
- Expand the following: $\sum_{k=0}^4 \binom{4}{k} x^k y^{4-k}$

XIV. Functions

Let $f(x) = 2x + 9$ and $g(x) = 16 - x^2$. Find the following.

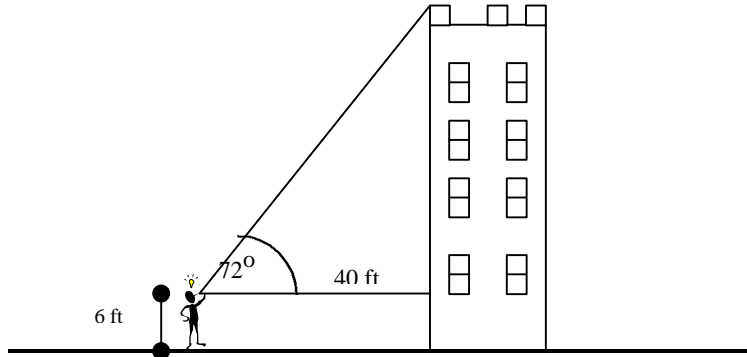
- $f(-3) + g(2)$
- $f(5) - g(4)$
- $f(-1) \cdot g(-2)$
- $\frac{f(5)}{g(5)}$
- $(g \circ f)(-2)$
- $f(g(x))$
- $f^{-1}(2)$
- $f(f^{-1}(3))$

XI. Fundamental Counting Rule, Factorials, Permutations, & Combinations

- Evaluate: $\frac{8!}{3!(8-3)!}$
- A particular new car model is available with five choices of color, three choices of transmission, four types of interior, and two types of engines. How many different variations of this model are possible?
- In a horse race, how many different finishes among the first three places are possible for a ten-horse race?
- How many ways can a three-person subcommittee be selected from a committee of seven people? How many ways can a president, vice president, and secretary be chosen from a committee of seven people?

XII. Trigonometry

1. Graph the following through one period: $f(x) = \sin x$
2. Graph the following through one period: $g(x) = \cos(2x)$
3. A man whose eye level is 6 feet above the ground stands 40 feet from a building. The angle of elevation from eye level to the top of the building is 72° . How tall is the building.



4. A man standing at the top of a 65m lighthouse observes two boats. Using the data given in the picture, determine the distance between the two boats.

