

# What to Expect on the Math Portion of the ACT

## Test Format:

There are 60 questions and you have 60 minutes to complete this portion.

The questions are broken down as follows:

- Pre- algebra – 14 questions
- Elementary Algebra – 10 questions
- Intermediate Algebra – 9 questions
- Coordinate Geometry – 9 questions
- Plane Geometry – 14 questions
- Trigonometry – 4 Questions

## NOTES/ TIPS:

- All questions are of equal weight
- You are NOT penalized for guessing
- Pace Yourself
- Don't leave questions blank at the end
- Mark up your exam
  - Circle if don't finish
  - Cross of problems you can rule out
- Check your answers if you do have time left
- Can use a calculator
  - Check that yours is working with batteries
  - Can not share
  - Make sure you know how to use it

# ALGEBRA – Pre-Algebra

## (14 Questions)

### 1) Properties of Numbers

EXAMPLE:

Which one of the following expressions has an even integer value for all integers  $a$  and  $c$  ?

- A.  $8a + 2ac$
- B.  $3a + 3c$
- C.  $2a + c$
- D.  $a + 2c$
- E.  $ac + a^2$

### 2) Arithmetic Operations (using fractions, whole numbers, and decimals)

EXAMPLE:

$$43 + (5 \times 3) - 2 = ?$$

- A. 42
- B. 56
- C. 289
- D. 337
- E. 481

### 3) Factors

EXAMPLE:

What is the greatest common factor of 42, 126, and 210 ?

- A. 2
- B. 6
- C. 14
- D. 21
- E. 42

### 4) Ratios, Proportions and Percents

EXAMPLE:

A typical high school student consumes 67.5 pounds of sugar per year. As part of a new nutrition plan, each member of a track team plans to lower the sugar he or she consumes by at least 20% for the coming year.

Assuming each track member had consumed sugar at the level of a typical high school student and will adhere to this plan for the coming year, what is the maximum number of pounds of sugar to be consumed by each track team member in the coming year?

- A. 14
- B. 44
- C. 48
- D. 54
- E. 66

5) Exponents

EXAMPLE:

Which of the following is equivalent to  $(x)(x)(x)(x^3)$ , for all  $x$ ?

- A.  $4x$
- B.  $6x$
- C.  $x^6$
- D.  $4x^6$
- E.  $4x^4$

6) Scientific Notation

EXAMPLE:

A particle travels  $1 \times 10^6$  meters per second in a straight line for  $5 \times 10^{-6}$  seconds. How many meters has it traveled?

- A.  $2 \times 10^{11}$
- B.  $5 \times 10^{12}$
- C.  $5 \times 10^{-12}$
- D. 5
- E.  $5 \times 10^{-36}$

7) Square Roots

EXAMPLE:

Which of the following is equal to  $\sqrt{45}$  ?

- A) 15
- B)  $5\sqrt{3}$
- C)  $9\sqrt{5}$
- D)  $3\sqrt{5}$
- E) 3

8) Absolute Value

EXAMPLE:

$|5 - 2| - |6 - 9| = ?$

- A. 6
- B. 0
- C. -8
- D. 22
- E. -6

9) Linear Equations in 1 Variable

EXAMPLE:

What is the value of  $x$  when  $2x + 3 = 3x - 4$  ?

- A. -7
- B.  $-\frac{1}{5}$
- C. 1
- D.  $\frac{1}{5}$
- E. 7

10) Simple Probability and Counting Techniques

EXAMPLE:

What is the probability that a number selected at random from the set  $\{2, 3, 7, 12, 15, 22, 72, 108\}$  will be divisible by both 2 and 3 ?

- A.  $\frac{1}{4}$
- B.  $\frac{3}{8}$
- C.  $\frac{3}{5}$
- D.  $\frac{5}{8}$
- E.  $\frac{7}{8}$

11) Simple Descriptive Statistics

EXAMPLE:

The distribution of Jamal's high school grades by percentage of course credits is given in the circle graph below. What is Jamal's grade point average if each A is worth 4 points; each B, 3 points; and each C, 2 points?

- A. 3.0
- B. 3.4
- C. 3.6
- D. 3.7
- E. Cannot be determined from the given information



## ALGEBRA – Elementary Algebra

(10 Questions)

1) Evaluate Algebraic Expressions with Substitution

EXAMPLE:

If  $a = 3$ , then  $2 / (1/7 + 1/a) = ?$

- A) 5
- B)  $21/10$
- C) 20
- D) 10
- E)  $21/5$

2) Use Variables to Express Functional Relationships

EXAMPLE:

Which of the following equations represents the linear relationship between time,  $t$ , and velocity,  $v$ , shown in the table below?

$T$	0	1	2
$V$	120	152	184

- A.  $v = 32t$
- B.  $v = 32t + 120$
- C.  $v = 120t$
- D.  $v = 120t + 32$
- E.  $v = 120t + 120$

3) FOIL and Factor

EXAMPLE:

Which of the following is a factor of the polynomial  $2x^2 - 3x - 5$  ?

- A.  $x - 1$
- B.  $2x - 3$
- C.  $2x - 5$
- D.  $2x + 5$
- E.  $3x + 5$

4) Exponents and Square Roots

5) Understanding Algebraic Expressions

EXAMPLE:

For all nonzero real numbers  $p$ ,  $t$ ,  $x$ , and  $y$  such that  $\frac{x}{y} = \frac{3p}{2t}$ , which of the following expressions is equivalent to  $t$  ?

- A.  $\frac{y}{2}$
- B.  $\frac{3px}{2y}$
- C.  $\frac{6py}{x}$
- D.  $\frac{3py}{x}$
- E.  $\frac{3py}{2x}$

## ALGEBRA – Intermediate Algebra

(9 Questions)

1) Quadratic Formula

2) Rational and Radical Expressions

EXAMPLE:

Which of the following is equivalent to  $\frac{5}{k} + \frac{k+3}{k+5}$  ?

- A.  $\frac{k+8}{2k+5}$
- B.  $\frac{k+8}{k(k+5)}$
- C.  $\frac{5(k+3)}{k(k+5)}$
- D.  $\frac{k^2+3k}{5k+25}$
- E.  $\frac{k^2+8k+25}{k(k+5)}$

3) Absolute Value and Inequalities

EXAMPLE:

What are the values of  $a$  and  $b$ , if any, where  $-a|b+4| > 0$ ?

- A)  $a > 0$  and  $b \neq -4$
- B)  $a > 0$  and  $b \neq 4$
- C)  $a < 0$  and  $b \geq -4$
- D)  $a < 0$  and  $b \neq -4$
- E)  $a < 0$  and  $b \leq -4$

4) Basic Sequences and Patterns

EXAMPLE:

What is  $x$ , the second term in the geometric series  $\frac{1}{4} + x + \frac{1}{36} + \frac{1}{108} + \dots$  ?

- A.  $\frac{1}{3}$
- B.  $\frac{1}{9}$
- C.  $\frac{1}{12}$
- D.  $\frac{1}{16}$
- E.  $\frac{1}{18}$

5) Systems of Equations

EXAMPLE:

When graphed in the  $(x,y)$  coordinate plane, at what point do the lines  $2x + 3y = 5$  and  $x = -2$  intersect?

- A)  $(-2,0)$
- B)  $(-2,5)$
- C)  $(0,5/3)$
- D)  $(0,5)$
- E)  $(-2,3)$

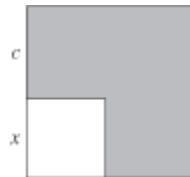
6) Quadratic Inequalities

7) Functions and Modeling

EXAMPLE:

Each side of the smaller square in the figure below is  $x$  inches long, and each side of the larger square is  $c$  inches longer than a side of the smaller square. The area of the larger square is how many square inches greater than the area of the smaller square?

- A.  $c^2$
- B.  $Xc$
- C.  $4c$
- D.  $(x + c)^2$
- E.  $2xc + c^2$



8) Matrices

9) Complex Numbers

EXAMPLE:

$$\sqrt{-(-9)^2} = ?$$

- A.  $9i$
- B.  $9 + i$
- C.  $9 - i$
- D.  $9$
- E.  $-9$

10) Roots

EXAMPLE:

What is the  $x$ -intercept of the graph of  $y = x^2 - 4x + 4$  ?

- A. -2
- B. -1
- C. 0
- D. 1
- E. 2

## GEOMETRY – Coordinate Geometry (9 Questions)

1) Equations and Graphs (points, lines and planes)

EXAMPLE:

In the standard  $(x, y)$  coordinate plane below, 3 of the vertices of a rectangle are shown. Which of the following is the 4th vertex of the rectangle?

- A.  $(3, -7)$
- B.  $(4, -8)$
- C.  $(5, -1)$
- D.  $(8, -3)$
- E.  $(9, -3)$

2) Slope

EXAMPLE:

What is the slope of any line parallel to the line  $9x + 4y = 7$  ?

- A. -9
- B.  $-\frac{9}{4}$
- C.  $\frac{9}{7}$
- D. 7
- E. 9

3) Parallel and Perpendicular Lines

EXAMPLE:

Which of the lines below is not parallel to the line  $6x - 2y = 10$ ?

- A)  $3x - y = 7$
- B)  $-6x + 2y = 20$
- C)  $3x + y = 7$
- D)  $6x - 2y = 5$
- E)  $x - y/3 = 9$

4) Distance and Midpoint

EXAMPLE:

A boat departs Port Isabelle, Texas, traveling to an oil rig. The oil rig is located 9 miles east and 12 miles north of the boat's departure point. About how many miles is the oil rig from the departure point?

- A. 3
- B.  $\sqrt{63}$
- C. 15
- D. 21
- E. 225

5) Properties of a Circle

EXAMPLE:

Which of the following is an equation of the circle with its center at (0,0) that passes through (3,4) in the standard (x,y) coordinate plane?

- A.  $x - y = 1$
- B.  $x + y = 25$
- C.  $x^2 + y = 25$
- D.  $x^2 + y^2 = 5$
- E.  $x^2 + y^2 = 25$

6) Pythagorean Theorem

EXAMPLE:

If the hypotenuse of a right triangle is 10 inches long and one of its legs is 5 inches long, how long is the other leg?

- A) 5
- B)  $5\sqrt{3}$
- C)  $5\sqrt{5}$
- D) 75
- E)  $10 - \sqrt{5}$

7) Graphing Inequalities

8) Conics

## GEOMETRY – Plane Geometry

(14 Questions)

1) Angles and Lines:

2) Properties of :

a. Circles

EXAMPLE:

A circle has a circumference of  $16\pi$  feet. What is the radius of the circle, in feet?

- A.  $\sqrt{8}$
- B. 4
- C. 8
- D. 16
- E. 32

b. Triangles

c. Rectangles

EXAMPLE:

A rectangle with a perimeter of 30 centimeters is twice as long as it is wide. What is the area of the rectangle in square centimeters?

- A. 15
- B. 50
- C. 200
- D.  $3\sqrt{15}$
- E.  $6\sqrt{15}$

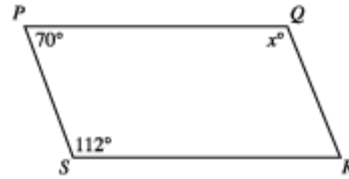


d. Parallelograms

EXAMPLE:

In quadrilateral  $PQRS$  below, sides  $PS$  and  $QR$  are parallel for what value of  $x$  ?

- A. 158
- B. 132
- C. 120
- D. 110
- E. 70



e. Trapezoids

EXAMPLE:

The area of a trapezoid is  $0.5 h (b_1 + b_2)$ , where  $h$  is the altitude, and  $b_1$  and  $b_2$  are the lengths of the parallel bases. If a trapezoid has an altitude of 15 inches, an area of 105 square inches, and one of the bases 22 inches, what is the perimeter, in inches, of the trapezoid?

- A) 8
- B) 45
- C) 60
- D) 30
- E) This trapezoid does not exist.

3) Transformations

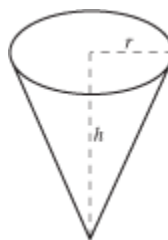
4) Proof and Proof Techniques

5) Volume and 3D Applications

EXAMPLE:

The volume,  $V$ , of the right circular cone with radius  $r$  and height  $h$ , shown below, can be found using the formula  $V = \frac{1}{3} \pi r^2 h$ . A cone-shaped paper cup has a volume of 142 cubic centimeters and a height of 8.5 centimeters. What is the radius, to the nearest centimeter, of the paper cup?

- A. 2
- B. 4
- C. 8
- D. 12
- E. 16



# TRIGONOMETRY

(4 Questions)

## 1) SOH CAH TOA

EXAMPLE: Which of the following is the sine of  $\angle A$  in the right triangle below?

- A.  $\frac{5}{13}$
- B.  $\frac{5}{12}$
- C.  $\frac{12}{13}$
- D.  $\frac{12}{5}$
- E.  $\frac{13}{5}$

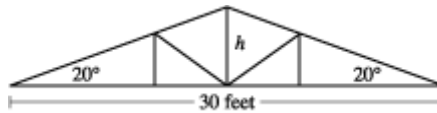


## 2) Solving Triangles

EXAMPLE:

Which of the following expressions is the closest approximation to the height  $h$ , in feet, of the roof truss shown below?

- A.  $15 \tan 20^\circ$
- B.  $15 \sin 20^\circ$
- C.  $30 \tan 20^\circ$
- D.  $30 \sin 20^\circ$
- E.  $\frac{15}{\sin 20^\circ}$



## 3) Trigonometric Identities

EXAMPLE:

Which of the following is equivalent to  $\sin^\theta \csc(-\theta)$  wherever  $\sin^\theta \csc(-\theta)$  is defined?

- A.  $-1$
- B.  $1$
- C.  $-\tan \theta$
- D.  $\tan \theta$
- E.  $-\sin^2 \theta$

## 4) Solving Trig Equations

EXAMPLE:

If  $\sin 2x = \sin x$ , then which of the following could NOT be true?

- A.  $x = 0$
- B.  $x =$
- C.  $\cos x =$
- D.  $\sin x = 0$
- E.  $\cos x = 0$

## 5) Graphing Trig Equations

# What if I don't have a Clue?

\*\*\*\*\*NOTE\*\*\*\*\*

THESE HINTS DO NOT ALWAYS WORK. They may help if you really have no idea how to solve the problem. If you have solved the problem and it does not seem to go along with these, GO WITH YOUR ANSWER!!

- 1) Rule out options – remember they try to trick you!!
- 2) Pictures are often drawn to scale (even if they say they are not)
- 3) Lists of Numbers – select a middle number
- 4) Solving, simplifying, reduce, – plug in a number

EXAMPLES:

1.  $2x^2 - 10x + 12 =$ 
  - a)  $(2x - 3)(x - 4)$
  - b)  $[2(x - 3)]^2$
  - c)  $2(x - 2)(x - 3)$
  - d)  $2(x + 6)(x - 1)$
  - e)  $2x(x - 5)(x - 1)$
2. Where defined  $\frac{18x^3y^8z}{-6x^2y^4z} =$ 
  - a)  $-3xy^4$
  - b)  $-3xy^2$
  - c)  $\frac{xy^4}{3}$
  - d)  $\frac{1}{3xy^2}$
  - e)  $\frac{y^4}{3x}$
3. Reduce to lowest terms,  $\frac{2x^2 - 3x - 2}{10 + x - 3x^2}$ 
  - a)  $\frac{2x + 1}{5 - 3x}$
  - b)  $\frac{1 - 2x}{3x - 5}$
  - c)  $\frac{2x + 1}{3x + 5}$
  - d)  $\frac{2x + 1}{3x - 5}$
  - e)  $\frac{-2x - 1}{3x + 5}$

- 5) Convert square roots or pi's to decimals.