Things to know for the ACT

Pre-Algebra (14 questions) Elementary Algebra (10 questions)
Intermediate Algebra (9 questions)

Algebra: Rules for exponents

1. $a^m \cdot a^n = a^{m+n}$ $\quad a^2 \cdot a^3 = a^{2+3} = a^5$
2. $\frac{a^m}{a^n} = a^{m-n}$ $\quad \left(\frac{a^5}{a^3} = a^{5-3} = a^2\right)$
3. $(a^m)^n = a^{mn}$ $\quad (a^2)^3 = a^{2\cdot 3} = a^6$
4. $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$ $\quad \left(\frac{a}{b}\right)^3 = \frac{a^3}{b^3}$
5. $a^0 = 1$
6. $a^{-n} = \frac{1}{a^n}$ $\quad \left(a^{-2} = \frac{1}{a^2}\right)$

Algebra: Simplifying

$(x-4)^2 = (x-4)(x-4) = x^2 - 8x + 16$

Algebra: Factoring

If it is a binomial: $x^2 - 9 = (x+3)(x-3)$

1) Look for the greatest common factor
2) Look for a difference of squares.
   This means that the two terms of the binomial are perfect squares and there is a minus sign between them.

For a trinomial $x^2 - 4x - 12 = (x-6)(x+2)$

1) Look for the greatest common factor
2) Determine what the signs are
   1) If the last term is positive the signs are both the same as the middle term
   2) If the last term is negative the signs are opposites(one is positive and one is negative)
3) Look at the first term. If there is not a number in front of the squared term then you only need to look at factors of the last term that will add or subtract to get the middle term
4) Look at the first term. If there is a number in front of the squared term, you must look at factors of the first term and of the last term. In this situation you must always guess and check.

Algebra: Scientific Notation

$3.6 \times 10^4 = 36000$

$3.6 \times 10^{-4} = .00036$

Algebra: Rational/Irrational Numbers

Rational: numbers that include the negatives, 0, positives, fractions, and decimals that show a pattern or terminate (for example .6666666666666 or 1/3 or .125)

Irrational: numbers that their decimals have no pattern (for example: $\pi = 3.141592\ldots$)

Algebra: Perfect Squares

1,4,9,16,25,36,49,64,81,100

Algebra: Simplifying Square Roots

1) $\sqrt{20} = \sqrt{4}\sqrt{5} = 2\sqrt{5}$
2) $\sqrt{6} \cdot \sqrt{8} = \sqrt{48} = \sqrt{16}\sqrt{3} = 4\sqrt{3}$
3) $\sqrt{n} \cdot \sqrt{n} = n$ $\quad \sqrt{3} \cdot \sqrt{3} = 3$

Algebra: Equations

1) Solving Equations: $-5x - 21 = 2x$
2) Solving Proportions $\frac{9}{6} = \frac{x}{8}$
3) Absolute Value (two answers):
$$|x-2| = 4$$

Algebra: Lines

$y = mx + b$ (slope intercept form)

1) m=slope and b = y-intercept

2) slope=$m=\frac{y_2 - y_1}{x_2 - x_1}$

3) 2 lines are parallel if their slopes are the same $\left(\text{m}=\frac{2}{3} \text{ and m}=\frac{2}{3}\right)$

4) 2 lines are perpendicular $\perp$ if their slopes are opposites and reciprocals $\left(\text{m}=\frac{2}{3} \text{ and m}=\frac{-3}{2}\right)$

Algebra: Conic Sections (circles/parabolas)

Circle:

$(x-h)^2 + (y-k)^2 = r^2$ center: (h,k)

Parabola:

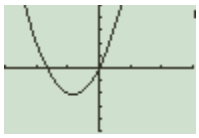
$y = a(x-h)^2 + k$ center: h,k

Algebra: Quadratic Formula (Used to solve an equation involving x^2)

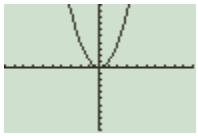
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Algebra: The Discriminant ($b^2 - 4ac$) tells you how many times a parabola crosses the x-axis

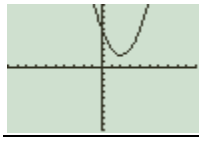
$b^2 - 4ac > 0$ twice (2 solutions)



$b^2 - 4ac = 0$ one (2 solutions)



$b^2 - 4ac < 0$ none



Geometry:
Coordinate Geometry (9 questions)
Plane Geometry (14 questions)

Geometry: Distance and Midpoint Formula

Distance Formula = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Midpoint Formula = $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

Geometry: Area and Perimeter

Perimeter = Add up the sides

$\text{Re}\,c\tan gle / Square: \quad A = lh$

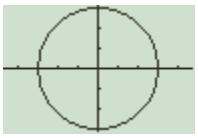
$Triangle: \quad A = \frac{1}{2}bh$

$Trapezoid: \quad A = \frac{1}{2}h\ (b_1 + b_2)$

Geometry: Circles

Circumference: $C = 2\pi r$

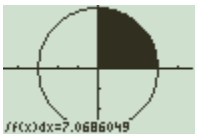
Circle: $A = \pi r^2$



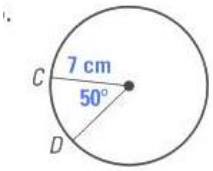
Sector of a circle: $A = \frac{\theta^\circ}{360^\circ}\pi r^2$

θ (*pronounced theta*)

θ is an angle in degrees



Length of an arc: $S = \frac{\theta^\circ}{360^\circ}\pi d$



Probability

$$\text{Probability} = \frac{\text{the desired outcome}}{\text{total possible outcomes}}$$

Sequences

The sum of an arithmetic series such as
1 + 3 + 5 + 7 + 9 + 11 + 13 is

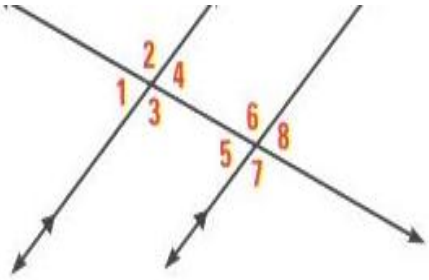
$$S = \frac{n}{2}(a_1 + a_n) = \frac{7}{2}(1+13)$$

n - number of terms you are adding up

a_1 - the first term

a_n - the last term

Geometry: Parallel Lines



1) Vertical angles are equal
$\angle 1 = \angle 4,\ \angle 2 = \angle 3,\ \angle 5 = \angle 8,\ \angle 6 = \angle 7$

2) Alternating interior angles are equal
$\angle 3 = \angle 6,\ \angle 4 = \angle 5$

3) Alternating exterior angles are equal
$\angle 2 = \angle 7,\ \angle 1 = \angle 8$

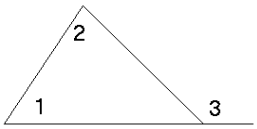
4) Corresponding angles are equal
$\angle 2 = \angle 6,\ \angle 4 = \angle 8,\ \angle 1 = \angle 5,\ \angle 3 = \angle 7$

5) Consecutive angles add up to 180°
$\angle 1 + \angle 2,\ \angle 1 + \angle 3,\ \angle 2 + \angle 4,\ \angle 3 + \angle 4$
$\angle 5 + \angle 6,\ \angle 5 + \angle 7,\ \angle 6 + \angle 8,\ \angle 7 + \angle 8$

Geometry: Triangles

1) The angles of a triangle add up to 180°

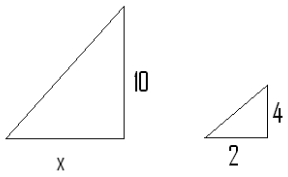
2) The exterior angle of a triangle equals the sum of the 2 remote interior angles $\angle 1 + \angle 2 = \angle 3$



Geometry: Pythagorean Triples [a, b, c]

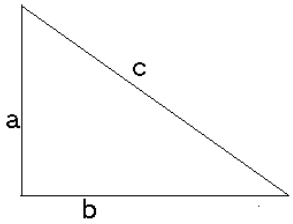
[3,4,5] and all multiples of [3,4,5]
such as [6,8,10] (multiply by 2)
and [9,12,15] (multiple by 3)
[5,12,13] and all multiples of [5,12,13]
[7,24,25] and all multiples of [7,24,25]
[8,15,17] and all multiples of [8,15,17]

Similar Triangles



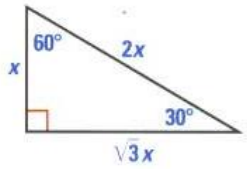
$$\frac{x}{10} = \frac{4}{2}$$

Geometry: Right Triangles

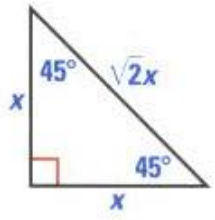


Pythagorean Theorem: $a^2 + b^2 = c^2$

Geometry: Special Triangles



Hypotenuse = 2 · shorter leg
Longer leg = √3 · shorter leg



Hypotenuse = √2 · leg

Trigonometry: Identities

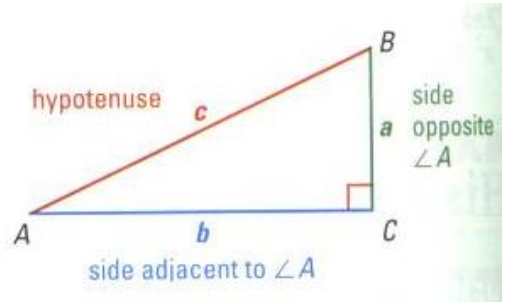
$$\sin^2\theta + \cos^2\theta = 1$$
$$\sin^2\theta = 1 - \cos^2\theta$$
$$\cos^2\theta = 1 - \sin^2\theta$$

Trigonometry: Values of sine and cosine

y = sinx and y = cosx
1) The maximum value of sine and cosine is 1
2) The minimum value of sine and cosine is -1

*y = **4**sinx and y = **4**cosx*
1) The maximum value of sine and cosine is 4
2) The minimum value of sine and cosine is -4

Trigonometry: Right Triangles



$$\sin\theta = \frac{\text{Opposite}}{\text{Hypotenuse}} = \frac{a}{c}$$
$$\cos\theta = \frac{adjacent}{\text{Hypotenuse}} = \frac{b}{c}$$
$$\tan\theta = \frac{\text{Opposite}}{adjacent} = \frac{a}{b}$$

These trigonometric functions can be remembered
by using the following acronym:
SOHCAHTOA

S ine
O pposite
H ypotenuse
C osine
A djacent
H ypotenuse
T angent
O pposite
A djacent