

ACT Study Guide

Know all factoring rules:

- | | |
|--|---|
| 1. GCF | Ex. $3x^2 + 9x = 3x(x + 3)$ |
| 2. Difference of 2 Perfect Squares: | Ex. $x^2 - 9 = (x + 3)(x - 3)$ |
| 3. Factoring trinomials | Ex. $x^2 + 6x + 9 = (x + 3)(x + 3)$
Ex. $2x^2 - 5x - 12 = (2x + 3)(x - 4)$ |
| 4. Factoring 4 terms by grouping
pattern of 2+2 | Ex. $y^2 + y + xy + x$
$y(y + 1) + x(y + 1)$
$(y + 1)(y + x)$ |

(Hint: remember if solving a quadratic equation by factoring, set one side equal to zero first.)

5. Know the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

(tune of Pop goes the Weasel)

start with the quadratic equation in standard form: $ax^2 + bx + c = 0$

6. The discriminant $= b^2 - 4ac$
tells what kind of solutions you have
- If $b^2 - 4ac = 0$, then 1 solution
 - If $b^2 - 4ac > 0$ (positive) & perfect square, then 2 rational real solutions
 - If $b^2 - 4ac > 0$ (positive) & not perfect square, then 2 irrational real solutions
 - If $b^2 - 4ac < 0$ (negative), then 2 imaginary solutions

FORMULAS to memorize

- | | |
|---------------------|---|
| 7. Distance formula | $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ |
| 8. Midpoint formula | $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ |

(average the x's, average the y's)

- | | |
|------------------------------|-----------------------------|
| 9. Circumference of a circle | $C = 2\pi r$ or $C = \pi d$ |
| 10. Area of a circle | $A = \pi r^2$ |
| 11. Area of a rectangle | $A = lw$ |
| 12. Area of a square | $A = s^2$ |
| 13. Area of a triangle | $A = \frac{1}{2}bh$ |

14. Area of a trapezoid

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

15. Perimeter of any figure =
sum of all of the sides

16. Surface area of any figure =
sum of all of the areas of all of the faces

17. Volume of any figure = Area of the base times the height

$$V = Bh$$

Right triangles

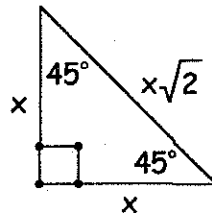
18. Pythagorean Theorem

$$a^2 + b^2 = c^2$$

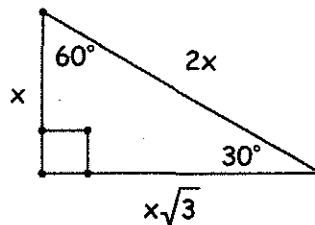
(c is the side across from the right angle)

Special Right Triangles

19. 45-45-90 degree triangle relationship



20. 30-60-90 degree triangle relationship



21. Circle

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

(h, k) = center, r = radius

22. Ellipse

$$\frac{(x - h)^2}{a^2} + \frac{(y - k)^2}{b^2} = 1$$

(h, k) = center

23. Hyperbola

$$\frac{(x - h)^2}{a^2} - \frac{(y - k)^2}{b^2} = 1$$

(h, k) = center

24. Parabola

$$y = a(x - h)^2 + k \quad x = a(y - k)^2 + h$$

$$(h, k) = \text{vertex} \quad (h, k) = \text{vertex}$$

Graphing concepts

25. Slope-Intercept form

$$y = mx + b$$

26. Point-Slope form

$$y - y_1 = m(x - x_1)$$

27. Slope

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

TERMS to know for directions

28. sum - answer to an addition problem

29. difference - answer to a subtraction problem

30. product - answer to a multiplication problem

31. quotient - answer to a division problem

32. simplify - perform all operations (add, subtract, multiply, divide, reduce fractions)

33. solve - find out what the variable equals

Hint: If you don't know how to solve the problem quickly, take the possible answers and plug them into the equation to find the one that checks (gives you the same number on both sides).

34. quadratic equation - an equation where the highest power is 2.

35. know all properties

36. complementary angles - sum of the angles = 90°

37. supplementary angles - sum of the angles = 180°

Functions

38. substitute into a function equation

Ex. $f(x) = x^2 - 3x$, find $f(5m)$

$$f(5m) = (5m)^2 - 3(5m)$$

$$f(5m) = 25m^2 - 15m$$

39. composite functions - work from right to left Ex.

If $f(x) = x^2 - 3x$ and $g(x) = x + 2$,

find $f(g(x))$ or $f \circ g(x)$.

$$\sqrt{f(g(x))} \text{ or } \sqrt{f \circ g(x)}$$

$$f(g(x)) \text{ or } f \circ g(x) = (x+2)^2 - 3(x+2)$$

$$f(g(x)) \text{ or } f \circ g(x) = (x+2)(x+2) - 3(x+2)$$

$$f(g(x)) \text{ or } f \circ g(x) = x^2 + 4x + 4 - 3x - 6$$

$$f(g(x)) \text{ or } f \circ g(x) = x^2 + x - 2$$

Radicals

40. Rules for a simplified radical:

1. No perfect squares left under a radical. Ex. $\sqrt{50} = 5\sqrt{2}$

Ex. (If the index was something other than 2) $\sqrt[6]{x^6} = |x|$

2. No fractions left under a radical.

Ex. $\sqrt{\frac{3}{49}} = \frac{\sqrt{3}}{7}$

3. No radicals left in the denominator.

Ex. $\frac{2}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$

41. Combining like radicals - must have the same radicands (number under the radical).

(Add or subtract the coefficients, keep the same radicand.)

Ex. $3\sqrt{6} - 7\sqrt{6} = -4\sqrt{6}$

42. Definition of rational exponents

$$b^{\frac{p}{n}} = \sqrt[n]{b^p}$$

43. anything to the zero power

$$a^0 = 1$$

44. Evaluate a 2x2 determinant

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - cb$$

Ex. $\begin{vmatrix} 1 & 2 \\ 3 & 4 \end{vmatrix} = (1)(4) - (3)(2) = 4 - 6 = -2$

Logarithm rules

45. Convert from logarithmic form to exponential form

$$\log_b n = p$$

$$b^p = n$$

Ex. $\log_3 n = 2$

$$3^2 = n$$

$$n = 9$$

46. Convert from exponential form to logarithmic form

$$b^p = n$$

$$\log_b n = p$$

Ex. $5^p = 38$

$$\log_5 38 = p$$

47. Change of base formula

$$\log_a b = \frac{\log_b b}{\log_a b}$$

(now use change of base formula below)

Ex. $\log_5 38 = \frac{\log 38}{\log 5} = 2.2602$

48. Power Property of Logarithms

$$\log_b n^p = p \log_b n$$

Ex. $\log_3 x^2 = 2 \log_3 x$

49. Product Property of Logarithms

(The sum of the logs is their product.)

$$m > 0, n > 0, b > 0, b \neq 1$$

$$\log_b m + \log_b n = \log_b mn$$

Ex. $\log_3 2 + \log_3 x = \log_3 2x$

50. Quotient Property of Logarithms

(The difference of the logs is their quotient.)

$$m > 0, n > 0, b > 0, b \neq 1$$

$$\log_b m - \log_b n = \log_b \frac{m}{n}$$

Ex. $\log_3 x - \log_3 5 = \log_3 \frac{x}{5}$

51. When solving logarithmic equations, if you get both sides to be the log of the same base, drop the bases and set the numbers equal to each other and continue to solve.

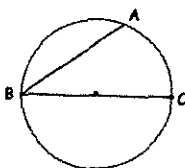
Polygons:

52. Sum of the interior angles of a polygon: $(n-2)180^\circ$

53. Sum of the exterior angles of a polygon, one angle at each vertex = 360°

Circles:

54. $m\angle ABC = \frac{1}{2}m \widehat{AC}$



55. SOH CAH TOA

