

9th Grade

Algebra Basics Test

No calculator for
the first 5 problems!

Simplify. (One point each.)

1) $(-5)(-2)$ $\textcircled{10}$

2) $-5 - 7$ $\textcircled{-12}$

3) $(15) \div (-3)$ $\textcircled{-5}$

4) $-3 + 13$ $\textcircled{10}$

5) $-7 + 2$ $\textcircled{-5}$

Calculator is permitted on the rest of
the test.

Solve. (3 points each.)

6) $3X - 8 = X + 12$

$$3X - X = 12 + 8$$

$$2X = 20$$

$$X = \frac{20}{2}$$

$$\textcircled{X = 10}$$

7) $10X - 9 = 5X - 17 + X$

$$10X - 9 = 6X - 17$$

$$10X - 6X = -17 + 9$$

$$4X = -8$$

$$X = \frac{-8}{4}$$

$$\textcircled{X = -2}$$

8) $6 - 5(X + 3) = 2X - 3 - X$

$$6 - 5X - 15 = X - 3$$

$$-5X - 9 = X - 3$$

$$-5X - X = 9 - 3$$

$$-6X = 6$$

$$X = \frac{6}{-6}$$

$$\textcircled{X = -1}$$

Solve for X in terms of Y.

(One point each.)

9) $Y = 2X + 5$

$$2X + 5 = Y$$

$$2X = Y - 5$$

$$\textcircled{X = \frac{Y-5}{2} \text{ or } X = \frac{1}{2}Y - \frac{5}{2}}$$

10) $3X - 5Y = 12$

$$3X = 5Y + 12$$

$$\textcircled{X = \frac{5Y+12}{3}}$$

$$\text{or } X = \frac{5}{3}Y + 4$$

Evaluate given that

$a = -\frac{1}{2}$, $b = 3$, $c = -5$

(2 points)

11) $4c - a^2$

$$4(-5) - \left(-\frac{1}{2}\right)^2$$

$$-20 - \frac{1}{4}$$

$$\rightarrow \textcircled{-20\frac{1}{4} \text{ or } -\frac{81}{4}}$$

Simplify. (1 point each.)

12) $9x^5 + 2x^5$ $11x^5$

13) $10y^3 + 5y^2$ *can't simplify*

14) $(x^2)^4$ x^8

15) $x^3 \cdot x^5$ x^8

Solve. (3 points each.)

16) $\frac{1}{5x+2} = \frac{2}{x+1}$

$$1(x+1) = 2(5x+2)$$

$$x+1 = 10x+4$$

$$x-10x = 4-1$$

$$-9x = 3$$

$$x = \frac{3}{-9}$$

$$x = -\frac{1}{3}$$

17) $12 + 3(2x - 4) = 6x$

$$12 + 6x - 12 = 6x$$

$$12 - 12 = 6x - 6x$$

$$0 = 0$$

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~~Any~~ Anything works!

18) $\frac{8}{9} = \frac{12}{x}$

$$x = \frac{9 \cdot 12}{8} = \frac{108}{8} = 13\frac{1}{2}$$

19) $\frac{2}{9}(3x - \frac{1}{2}) = \frac{1}{5}x + \frac{1}{3}$

$$\frac{2x}{3} - \frac{1}{9} = \frac{1}{5}x + \frac{1}{3}$$

$$\frac{2}{3}x - \frac{1}{5}x = \frac{1}{3} + \frac{1}{9}$$

$$\frac{10}{15}x - \frac{3}{15}x = \frac{3}{9} + \frac{1}{9}$$

$$\frac{7}{15}x = \frac{4}{9}$$

$$x = \frac{4}{9} \cdot \frac{15}{7} = \frac{20}{21}$$

$$x = \frac{20}{21}$$

Exponents & Polynomials Test

(1 point for each problem)

Simplify or Multiply.

1) $x^5 \cdot x^5$ x^{10}

2) $x^5 + x^5$ $2x^5$

3) $7x^2y^3 + 5x^2y^3$
 $12x^2y^3$

4) $(7x^3y)(5x^3y)$
 $35x^6y^2$

5) $5x^2 + 2y^3$ can't

6) $(2x^2y^3)^3$ $8x^6y^9$

7) $(x-4)(x+10)$
 $x^2 + 6x - 40$

8) $(x+5)^2$
 $x^2 + 10x + 25$

9) $7x^3(3x^2 - 5x + 4)$
 $21x^5 - 35x^4 + 28x^3$

10) $(x-7)(x+7)$
 $x^2 - 49$

11) $7(4x^4 - 3x^3)$
 $28x^4 - 21x^3$

12) $(3x^2)(5xy^4)(x^2y^3)$
 $15x^5y^7$

13) $5x^2 + 7x^3 - x^2$
 $4x^2 + 7x^3$

14) $6x^2(x^2 - 5x - 6)$
 $6x^4 - 30x^3 - 36x^2$

15) $10x^3 - 7x^3$
 $3x^3$

16) $13x^4 - 4x^2$ can't

17) $(x-9)^2$
 $x^2 - 18x + 81$

18) $(\frac{2}{3})^{-1}$ $\frac{3}{2}$

19) 3^0 1

20) $(x^3 - 5)(x^3 + 5)$
 $x^6 - 25$

21) $5y^2 - y^2$
 $4y^2$

22) $(x^2 + 8x + 3)(x + 2)$

$$\begin{array}{r} x+2 \\ \hline 2x^2 + 16x + 6 \\ x^3 + 8x^2 + 3x \\ \hline x^3 + 10x^2 + 19x + 6 \end{array}$$

23) $3xy^3(5x^3y)^2$
 $(3xy^3)(25x^6y^2)$
 $75x^7y^5$

24) $\sqrt{144x^{144}}$ $12x^{72}$

25) $(\frac{4x^{-4}}{7x^3})^{-2}$ $(\frac{4}{7x^7})^{-2}$
 $(\frac{7x^7}{4})^2 \rightarrow \frac{49x^{14}}{16}$

26) $3xy^4(x-3)(x+9)$
 $3xy^4(x^2 + 6x - 27)$
 $3x^3y^4 + 18x^2y^4 - 81xy^4$

27) **Convert into scientific notation:**
0.00073
 7.3×10^{-4}

28) $\frac{4xy^{-2}z^{-6}}{9x^5y^5}$
 $\frac{4}{9x^4y^7z^6}$

Factoring Test

Multiply.

1) $(x^3 - 3)(x^3 + 3)$

$x^6 - 9$

2) $(x^4 + 5y)^2$

$x^8 + 10x^4y + 25y^2$

Factor.

3) $x^2 - 10x + 16$

$(x-8)(x-2)$

4) $x^8 - 25$

$(x^4+5)(x^4-5)$

5) $5x^5 - 20x^3$

$5x^3(x^2-4)$
 $5x^3(x+2)(x-2)$

6) $x^2 + 9x - 20$

can't

7) $x^2 + x - 30$

$(x+6)(x-5)$

8) $6x^7y^5 - 4x^2y^3$

$2x^2y^3(3x^5y^2-2)$

9) $x^4 - 16$

$(x^2+4)(x+2)(x-2)$

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10) $8xy^6 + 14x^5z^3$

$2x(4y^6 + 7x^4z^3)$

11) $x^2 + 25x - 84$

$(x+28)(x-3)$

12) $x^2 - 25x + 84$

$(x-21)(x-4)$

13) $10x^5 + 10x^4 - 200x^3$

$10x^3(x^2+x-20)$

$10x^3(x+5)(x-4)$

14) $x^4 - 10x^2 + 16$

$(x^2-8)(x^2-2)$

15) $4x^2 + 8x + 140$

$4(x^2+2x+35)$

16) $x^6 - 25y^4$

$(x^3+5y^2)(x^3-5y^2)$

Solve.

17) $x^2 + 5x + 6 = 2x^2$

$0 = x^2 - 5x - 6$

$0 = (x-6)(x+1)$

$x = 6, -1$

18) $\frac{6}{x+13} = \frac{x}{x+3}$

$6x+18 = x^2+13x$

$0 = x^2+7x-18$

$0 = (x+9)(x-2)$

$x = -9, 2$

19) $3x - 5 = 7x - 9$

$4 = 4x$

$x = 1$

20) $(x-3)^2 = (x-7)(x+7)$

$x^2-6x+9 = x^2-49$

$-6x = -58$

$x = \frac{58}{6} = \frac{29}{3}$

21) $2x^4 - 48x^2 = 10x^3$

$2x^4 - 10x^3 - 48x^2 = 0$

$2x^2(x^2 - 5x - 24) = 0$

$2x^2(x-8)(x+3) = 0$

$x = 0, 8, -3$

22) $7x - 5 = x(x+7) - 105$

$0 = x^2 + 7x - 105 - 7x + 5$

$0 = x^2 - 100$

$x = \pm 10$

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Word Problem Test

Choose four out of the five problems to solve. Cross out the one you don't wish to do. (You can do the fifth one for extra credit.)

You must show work with equations in order to receive full credit.

- 1) Two consecutive odd integers are such that three times one of the numbers is seven more than twice the other number. Find the two numbers.

$$y = x + 2 \text{ or } x = y + 2$$

$$3x = 2y + 7$$

$$3(y+2) = 2y+7$$

$$3y+6 = 2y+7$$

$$y = 1$$
$$x = 3$$

$$3x = 2(x+2) + 7$$

$$3x = 2x + 4 + 7$$

$$x = 11$$
$$y = 13$$

- 2) The product of two numbers is 90, and one of the numbers is three more than three times the other number. Find the two numbers.

$$x \cdot y = 90$$

$$y = 3x + 3$$

$$x(3x+3) = 90$$

$$3x^2 + 3x - 90 = 0$$

$$3(x^2 + x - 30) = 0$$

$$3(x+6)(x-5) = 0$$

$$x = 6, 5 \quad (-6, -5)$$

$$(9, 18)$$

- 3) Jeff's age is three years less than twice Kate's age. Four years from now, Kate's age will be $\frac{2}{3}$ of Jeff's. Find both of their ages.

$$J = 2K - 3$$

$$K+4 = \frac{2}{3}(J+4)$$

$$K+4 = \frac{2}{3}(2K-3+4)$$

$$K+4 = \frac{4}{3}K + \frac{2}{3}$$

$$-\frac{1}{3}K = -3\frac{1}{3}$$

$$K = -\frac{10}{3} \cdot \frac{3}{1} = 10$$

$$K = 10$$
$$J = 17$$

- 4) Jeff biked from his house to his uncle's house averaging 18mph and then returned home averaging 15mph. If the return trip took 16 minutes longer, then how far is it from Jeff's house to his uncle's house?

$$\frac{16}{60} = \frac{4}{15}$$

$$D_1 = D_2$$

$$R_1 T_1 = R_2 T_2$$

$$T_2 = T_1 + \frac{4}{15}$$

$$18T_1 = 15\left(T_1 + \frac{4}{15}\right)$$

$$3T_1 = 4$$

$$T_1 = \frac{4}{3}$$

$$D_1 = R_1 T_1 = 18 \cdot \frac{4}{3} = 24 \text{ mi}$$

- 5) Maria has 32 coins worth \$4.55. How many of each type of coin are there if she has only quarters and dimes?

$$Q + D = 32$$

$$25Q + 10D = 455$$

$$25Q + 10(32 - Q) = 455$$

$$25Q - 10Q = 455 - 320$$

$$15Q = 135 \rightarrow Q = 9; D = 23$$

Quadratic Formula Test

You may not use any notes, nor use the workbook.

- 1) Give the quadratic formula.
- 2) Prove the quadratic formula.
(Hint: you should start with the *General Quadratic Equation*, which is $ax^2 + bx + c = 0$.)
- 3) How is al-Khwarizmi's version of the quadratic formula different than the modern version?
- 4) Solve $5x^2 - 10x + 4 = 0$ by using the quadratic formula. (Give dec. approx.)

$$x = \frac{10 \pm \sqrt{100 - 4(5)(4)}}{10}$$

$$x = \frac{10 \pm \sqrt{20}}{10} = \frac{10 \pm 2\sqrt{5}}{10} = \frac{5 \pm \sqrt{5}}{5}$$

$$x \approx 1.447, 0.553$$

- 5) Solve $x^2 + 12x + 27 = 0$ by using three methods:

- factoring
 - completing the square
 - using the quadratic formula
- You must show your work!

Factoring

$$x^2 + 12x + 27 = 0$$

$$(x+9)(x+3) = 0$$

$$x = -9, -3$$

Completing the Square

$$x^2 + 12x + 27 = 0$$

$$x^2 + 12x + 36 = -27 + 36$$

$$(x+6)^2 = 9$$

$$x+6 = \pm 3$$

$$x = -6 \pm 3$$

$$x = -9, -3$$

Quadratic Formula

$$x^2 + 12x + 27 = 0$$

$$x = \frac{-12 \pm \sqrt{144 - 4(1)(27)}}{2}$$

$$x = \frac{-12 \pm \sqrt{36}}{2}$$

$$x = \frac{-12 \pm 6}{2}$$

$$x = \frac{-18}{2}, \frac{-6}{2}$$

$$x = -9, -3$$

Algebra Year-End Test ^{9th} Grade

Simplify. (2 points each)

1) $4x^5 + 7x^5$

$11x^5$

2) $(4x^5)(7x^5)$

$28x^{10}$

3) $(x+5)^2$

$x^2 + 10x + 25$

4) $(4x^3)^2$

$16x^6$

5) $7x^2(x^2 + 7x - 5)$

$7x^4 + 49x^3 - 35x^2$

6) $5x^3y^2 + 4x^3 - 12x^3y^2$

$4x^3 - 7x^3y^2$

7) $(2x-3)(5x+2)$

$10x^2 - 11x - 6$

8) $(x-10)(x+1)(x-3)$

$(x^2 - 9x - 10)(x-3)$

$x^3 - 9x^2 - 10x - 3x^2 + 27x + 30$

$x^3 - 12x^2 + 17x + 30$

Simplify. (2 points each)

9) $\frac{3x^{-5}y^2}{6x^3y^{-3}z^{-2}}$

$\frac{y^2y^3z^2}{2x^3x^5}$

$\frac{y^5z^2}{2x^8}$

Evaluate each expression (2 points)

given that $x=3; y=-\frac{1}{2}$.

10) $2x^2 - 6y + xy$

$2 \cdot 9 + 3 + 3(-\frac{1}{2}) \rightarrow$

$\frac{39}{2}$ or $19\frac{1}{2}$

Factor. (2 points each)

11) $x^2 + 13x + 30$

$(x+10)(x+3)$

12) $x^2 - 13x - 30$

$(x-15)(x+2)$

13) $x^2 + 13x - 30$

$(x+15)(x-2)$

14) $x^2 - 13x + 30$

$(x-10)(x-3)$

15) $x^4 - 25$

$(x^2+5)(x^2-5)$

16) $x^2 + 9$

can't

17) $x^9 - 4x$

$x(x^8 - 4) \rightarrow x(x^4+2)(x^4-2)$

18) $10x^3 + 30x^2 - 40x$

$10x(x^2 + 3x - 4) \rightarrow 10x(x+4)(x-1)$

19) $12x^3y^5 - 4x^2y^3$

$4x^2y^3(3xy^2 - 1)$

Find the Common Solution. (4 points)

$$\begin{aligned} 20) \quad 3x - 4y &= 26 \rightarrow 3x = 4y + 26 \\ 2x + 5y &= -21 \end{aligned}$$

$$x = \frac{4}{3}y + \frac{26}{3}$$
$$2\left(\frac{4}{3}y + \frac{26}{3}\right) + 5y = -21$$

$$\frac{8}{3}y + \frac{52}{3} + 5y = -21$$

$$\frac{8}{3}y + \frac{15}{3}y = -21 - \frac{52}{3}$$

$$x = -2$$

$$\frac{23}{3}y = -\frac{115}{3}$$

$$y = -5$$

$$y = -\frac{115}{3} \cdot \frac{3}{23}$$

Solve. (4 points each)

Use the quadratic formula only if necessary.

$$21) \quad 7 + 3(x-4) = 5x - 4 - x$$

$$7 + 3x - 12 = 4x - 4$$

$$3x - 5 = 4x - 4$$

$$-x = 1$$

$$x = -1$$

$$22) \quad 3x^2 - 7x = 2x^2 + x + 20$$

$$3x^2 - 2x^2 - 7x - x - 20 = 0$$

$$x^2 - 8x - 20 = 0$$

$$(x-10)(x+2) = 0$$

$$x = 10, -2$$

$$23) \quad \frac{3}{x+4} = \frac{5}{3x-7}$$

$$3(3x-7) = 5(x+4)$$

$$9x - 21 = 5x + 20$$

$$4x = 41$$

$$x = \frac{41}{4} \text{ or } 10\frac{1}{4}$$

$$24) \quad x^2 + 3x = 7$$

$$x^2 + 3x - 7 = 0$$

$$x = \frac{-3 \pm \sqrt{9 - 4(-7)}}{2}$$

$$x = \frac{-3 \pm \sqrt{37}}{2}$$

$$25) \quad x^2 + 3x = 10x - 12$$

$$x^2 - 7x + 12 = 0$$

$$(x-3)(x-4) = 0$$

$$x = 3, 4$$

$$26) \quad (x+8)(x-3) = 26$$

$$x^2 + 5x - 24 = 26$$

$$x^2 + 5x - 50 = 0$$

$$(x+10)(x-5) = 0$$

$$x = -10, 5$$