1. Re-write $0.30\overline{72}$ as a fraction of integers.

2. Simplify each of the following.

   a) $\left(4\sqrt{3}-2\right)^2$

   b) $\sqrt{20}-3\sqrt{180}+\sqrt{500}$

   c) Rationalize the denominator in $\dfrac{6}{5-\sqrt{7}}$

   d) Find the exact value of x^2-5x+8 if $x=1-2\sqrt{3}$

3. Simplify each of the following.

   a) $\dfrac{2a^{-5}\left(2a^{-2}\right)^{-3}\left(-4a^0\right)}{\left(2a^{-2}\right)^{-3}\left(-4a\right)^2}$ b) $\dfrac{2^{-2}-3^{-2}}{1-2^{-1}\left(3^{-1}\right)}$ c) $\dfrac{3^{2x-3}2^{3x+1}}{6^{2x-1}}$

4. Let x denote the number 2^{143}. Simplify the expression $2^{143}+3\cdot 2^{144}+2^{145}$ and write it in terms of x.

5. Solve each of the following equations. Make sure to check your solution.

   a) $x^3=24x^2+217x$

   b) $\dfrac{3-x}{4}-\dfrac{10-3x}{5}=x+2$

   c) $(3x-2)(9-x)=5x-2(x-3)^2$

   d) $3(x-5)-5(x-1)=-2x+1$

   e) $18x^3=2x$

6. a) Solve $3x^2+5x=1$ by completing the square.

   b) Check your solution(s), using exact values.

7. Solve each of the following inequalities.

   a) $12x-2x^2>20$ b) $12x+x^2\geq 45$ c) $\dfrac{1}{3}x^2-4x\leq -12$ d) $-x^2+6x>1$

8. Solve each of the following system of linear equations.

   a) $\begin{cases} 3x-5y=-12 \\ y-x=4 \end{cases}$ b) $\begin{cases} 2x+5y=-11 \\ 3x-y=-25 \end{cases}$ c) $\begin{cases} 2x+3y=-1 \\ y=-\dfrac{2}{3}x+2 \end{cases}$

9. Completely factor each of the following.

   a) $4-6x^2-2x$ b) $2x^2-12x+20$ c) $a^3-x^2+a^3x^2-1$ d) $16y^4-1$

10. Factor each of the following by completing the square.

    a) $3x^2-4x-319$ b) $3x^2-3x+4$ c) $20x-2x^2-46$ d) $-4x^2+3x+7$

11. Graph each of the following equations.

    a) $y=-\dfrac{2}{3}x+1$ b) $y=8x-2x^2-6$ c*) $2x-3y+xy=6$

12. Suppose that x and y are real numbers with $x+3y=20$.

    a) Find the smallest possible value of x^2+y^2.

    b) Find the greatest value of xy.

    c) Find the smallest value of $(x-y)^2$.

    d) Find the greatest value of y^2-x^2.

13. A citrus grower estimates that if 60 orange trees are planted, the average yield per tree will be 400 oranges. The average yield will decrease by 4 oranges per tree for each additional tree planted on the same acreage. Find the total number of trees the grower should plant to maximize yield.

14. There is an animal farm where chickens and cows live. All together, there are 53 heads and 174 legs. How many chickens, how many cows?

15. We invested \$10000 into two bank accounts. One account earns 14% per year, the other account earns 8% per year. How much did we invest into each account if the combined interest from the two accounts is \$1238 after the first year?

16. Sally worked 50 hours last week and made \$495 for the week. For every hour worked over 40 her job pays time and a half. What is Sally's regular hourly pay rate?

17. The cost of manufacturing q units of a product is given by $C(q) = 6q^2 + 10q$. Suppose we can sell all q units for a total of $142q + 1674$ dollars. Find the maximum profit we can achieve.

18. a) One number is four less than three times another number. Find these numbers if their sum is 64.

    b) One number is four less than three times another number. Find these numbers if their product is 160.

    c) One number is four less than three times another number. Find the smallest possible value of their product.

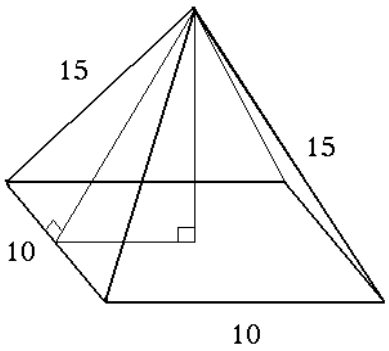
19. Find the distance between the points $A(-3, -5)$ and $B(3, 3)$.

20. Compute the exact value of the area of the triangle with sides 6, 6, and 8 units long.

21. a) Find the exact value of the area of a triangle with sides 8 m, 7 m, and 7 m long.
    b) Find the exact value of the area of a regular triangle with sides 5 meters long.

22. An arch is in the shape of a semicircle. At a point along the base 1 foot from an end of the arch, the height of the arch is 5 feet. Find the maximum height of the arch. Present exact value of the answer.

23. The picture below shows a straight pyramid with a square base. The sides of the base are 10 in long. The other sides are 15 in long.



    a) Find the height of a triangular face.

    b) Use part a) to find the height of the pyramid.

Answers

1.) $\frac{3042}{9900}$ 2.) a) $52-16\sqrt{3}$ b) $-6\sqrt{5}$ c) $\frac{\sqrt{7}+5}{3}$ d) $6\sqrt{3}+16$

3.) a) $-\frac{1}{2a^7}$ b) $\frac{1}{6}$ c) $\frac{4}{9}\cdot 2^x$ 4.) $11x$

5.) a) $-7, 0, 31$ b) -5 c) $0, 12$ d) no solution e) $-\frac{1}{3}, 0, \frac{1}{3}$ 6.) a) $\frac{-5\pm\sqrt{37}}{6}$

b) if $x=\frac{-5+\sqrt{37}}{6}$, then

$$\text{LHS} = 3x^2+5x = 3\left(\frac{-5+\sqrt{37}}{6}\right)^2+5\left(\frac{-5+\sqrt{37}}{6}\right) = 3\cdot\frac{25+37-10\sqrt{37}}{36}+5\cdot\frac{-5+\sqrt{37}}{6}$$

$$= \frac{62-10\sqrt{37}}{12}+\frac{-25+5\sqrt{37}}{6} = \frac{31-5\sqrt{37}}{6}+\frac{-25+5\sqrt{37}}{6} = \frac{31-5\sqrt{37}+25+5\sqrt{37}}{6} = \frac{6}{6} = 1 = \text{RHS}$$

7.) a) no solution b) $x\le -15$ or $x\ge 3$ c) $x=6$ d) $3-2\sqrt{2}<x<3+2\sqrt{2}$

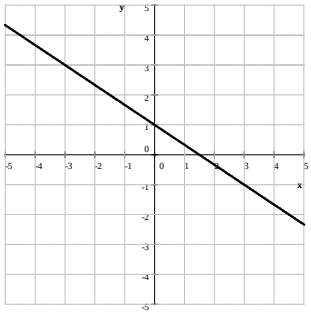
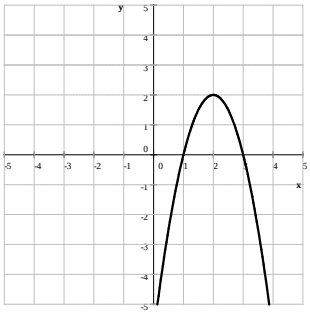
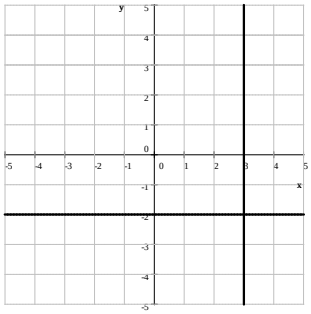
8.) a) $x=-4, y=0$ b) $x=-8, y=1$ c) no solution

9.) a) $-2(3x-2)(x+1)$ b) $2\left(x^2-6x+10\right)$ c) $\left(x^2+1\right)(a-1)\left(a^2+a+1\right)$

d) $\left(4y^2+1\right)(2y-1)(2y+1)$

10.) a) $3\left(x+\frac{29}{3}\right)(x-11)$ b) does not factor c) $-2\left(x-5+\sqrt{2}\right)\left(x-5-\sqrt{2}\right)$ d) $-4(x+1)\left(x-\frac{7}{4}\right)$

11.) a) $y=-\frac{2}{3}x+1$ b) $y=8x-2x^2-6$ c) $2x-3y+xy=6$

12.) a) 40 when $x=2, y=6$ b) $\frac{100}{3}$ when $x=\frac{10}{3}, y=\frac{10}{3}$ c) 0 when $x=5, y=5$

d) 50 when $x=-\frac{5}{2}, y=\frac{15}{2}$ 13.) if we plant 80 trees, then we will obtain a maximal yield of 25 600 oranges.

14.) 19 chickens and 34 cows 15.) \$7300 at 14% and \$2700 at 8% 16.) \$9 17.) \$2400

18.) a) 17 and 47 b) 8 with 20 and $-\frac{20}{3}$ with -24 c) $-\frac{4}{3}$ 19.) 10 units

20.) $8\sqrt{5}$ 21.) a) $4\sqrt{33}\,\text{m}^2$ b) $\frac{25}{4}\sqrt{3}\,\text{m}^2$ 22.) 13 ft

23.) a) $10\sqrt{2}\,\text{in}\approx 14.142\,136\,\text{in}$ b) $5\sqrt{7}\,\text{in}\approx 13.228\,757\,\text{in}$

References

1. Fractions and Decimals
2. Radical Expressions
3. Exponents 1
4. Exponents 1
5. Linear Equations, Factoring 1
6. Completing the Square Part 4, Radical Expressions
7. Quadratic Inequality
8. Systems of Linear Equations (substitution, elimination)
9. Factoring A, Factoring 1
10. Completing the Square 1, 2, 3, 4
11. Graphing Lines, Graphing Parabolas 1, 2,
12. Optimization
13. Optimization
14. Systems of Linear Equations (substitution, elimination)
15. Systems of Linear Equations (substitution, elimination)
16. Linear Word Problems
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18. a) Linear Word Problems
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19. Pythagorean Theorem
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