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

   a) $\begin{cases} 2x - y = 10 \\ x + 3y = 12 \end{cases}$ b) $\begin{cases} 4x + 3y = -12 \\ y = -\frac{4}{3}x + 8 \end{cases}$ c) $\begin{cases} 3x + y = 5 \\ x = -\frac{1}{3}y + \frac{5}{3} \end{cases}$

2. There is an animal farm where chickens and cows live. All together, there are 49 heads and 132 legs. How many chickens and how many cows are there at the farm?

3. We have 86 coins, all of them dimes and nickels. How many dimes do we have if the total value of all coins is \$6.15?

4. Simplify each of the following.

   a) $\left(\sqrt{2} - 1\right)\left(3\sqrt{2} + 1\right)$
   b) $\left(\sqrt{5} - 2\right)^2$
   c) $\left(\sqrt{7} + 2\right)\left(\sqrt{7} - 2\right)$
   d) $\left(\sqrt{7} - 2\right)^2$
   e) $\left(\sqrt{7} + 2\right)^2\left(\sqrt{7} - 2\right)^2$

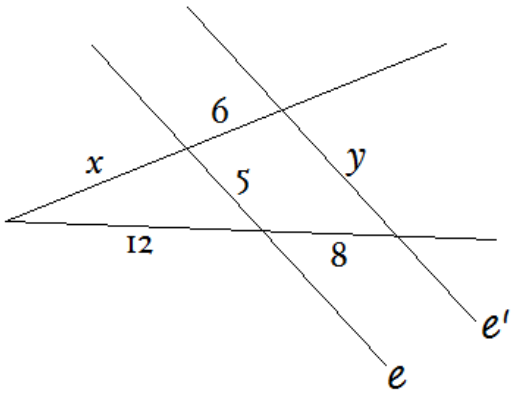
5. Rationalize the denominator in each of the following expressions.

   a) $\frac{1}{\sqrt{2}}$
   b) $\frac{3}{\sqrt{12}}$
   c) $\frac{5}{\sqrt{5}}$
   d) $\frac{1}{\sqrt{3} - 1}$
   e) $\frac{4}{1 - \sqrt{5}}$
   f) $\frac{3 - \sqrt{3}}{3 + \sqrt{3}}$

6. Solve each of the following quadratic equations over the real numbers.

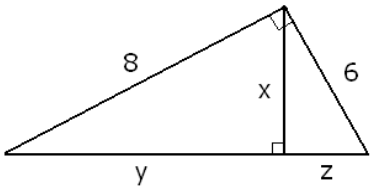
   a) $4x + x^2 = 21$
   b) $x^2 + 29 = 4x$
   c) $2x^2 - x = 3$
   d) $2x^2 - 12x = -18$
   e) $x^2 - 4x = 1$

7. Find the exact values of x and y based on the picture, given that e and e' are parallel lines.

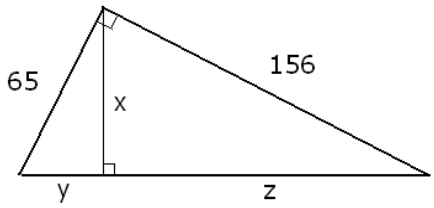


8. A person is standing 3 ft away from a street light that is 15.6 ft tall. How long is his shadow if he is 5.2 ft tall?

9. (Note: this problem requires the Pythagorean Theorem. If you know the Pythagorean Theorem, solve this problem. If not, skip it for now.) Find the exact value of x, y, and z, based on the figures shown below.

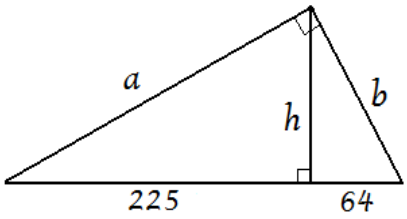


(a)

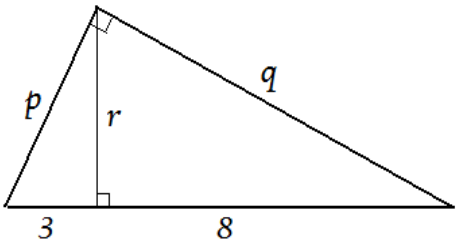


(b)

10. (Note: this problem requires the Pythagorean Theorem. If you know the Pythagorean Theorem, solve this problem. If not, skip it for now.) Find the exact value of a, b, and h and p, q, and r based on the picture below.



(a)

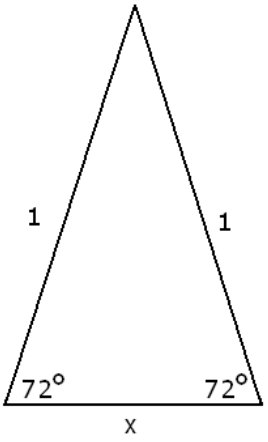


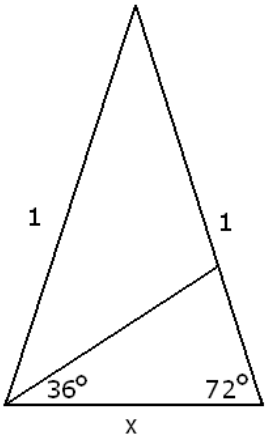
(b)

11. Enrichment problem (not for the quiz). Simplify $\dfrac{\sqrt{2}+\sqrt{6}}{\sqrt{2+\sqrt{3}}}$

12. Enrichment problem (not for the quiz) A rectangle has two sides as follows. The ratio of the shorter side to the longer side is the same as the ratio of the longer side to the sum of the two sides. If the longer side has length 1, how long is the shorter side in the rectangle?

13. Enrichment problem (not for the quiz) Consider the isosceles triangle shown on the picture. We draw the angle bisector of one of the base angles as shown on the picture. Now use similar triangles to find the exact value of x.





Answers

1.) a) $x = 6$ and $y = 2$ b) there is no solution c) there are infinitely many solutions: y can be any real number and then $x = -\frac{1}{3}y + \frac{5}{3}$

2.) 32 chickens and 17 cows 3.) 37 4.) a) $5 - 2\sqrt{2}$ b) $9 - 4\sqrt{5}$ c) 3 d) $11 - 4\sqrt{7}$ e) 9

5.) a) $\frac{\sqrt{2}}{2}$ b) $\frac{\sqrt{3}}{2}$ c) $\sqrt{5}$ d) $\frac{\sqrt{3}+1}{2}$ e) $-\sqrt{5} - 1$ f) $2 - \sqrt{3}$

6.) a) $-7, 3$ b) no real solution c) $-1, \frac{3}{2}$ d) 3 e) $2 - \sqrt{5}, 2 + \sqrt{5}$

7.) $x = 9$ and $y = \frac{25}{3}$ 8.) 1.5 ft

9.) a) $x = \frac{24}{5} = 4.8$, $y = \frac{32}{5} = 6.4$, $z = \frac{18}{5} = 3.6$ b) $x = 60$, $y = 25$, $z = 144$

10.) a) $h = 120$ $a = 255$ and $b = 136$ b) $r = \sqrt{24} = 2\sqrt{6}$ $p = \sqrt{33}$ and $q = \sqrt{88} = 2\sqrt{22}$