Assessment test II for those considering Math 120

Instructions for working the problems:

- You should allow yourself 90 minutes to solve the problems.

- Ideally, you should plan to work the problems in one session while focused exclusively on the test problems.

- Do not use graphing tools your calculator might provide. In Math 120, only non-graphing calculators are allowed, so create the same testing situation for yourself.

- Turn off all screens so you can focus and so that this will be a true indication of what you can do.

- Keep a record of your results so that you can easily find the problems you did solve and those you did not.

- If you do not get the correct answer on the first try, check your work and look for errors, or start again with perhaps a different method.

If you can complete all problems correctly, you have the kind of preparation necessary to do well in Math 120.

1. Two cyclists, A and B, ride on the same path. A rides at a speed of 20 miles per hour and B rides at a speed of 16 miles per hour. If it takes A half an hour less to complete the path than B, how long is the track?

2. A bacteria culture has an initial population of 100 at noon (12 pm).

   The population doubles every hour from noon (12 pm) to 3 pm, then it decreases by 40% every hour from 3 pm to 5 pm.

   What is the population at 5 pm?

3. A line intersects the x-axis at $x = 5$ and it passes through the point $(3, 4)$. Find the equation of the line.

4. A line intersects the y-axis at $y = -4$ and is perpendicular to the line $x - 3y + 2 = 0$. Find the equation of the line.

5. Solve the system of linear equations:

$$5x + 3y = 1$$
$$2x - y = 4$$

6. Find all solutions to the equation $-2x^2 + 7x = 5$.

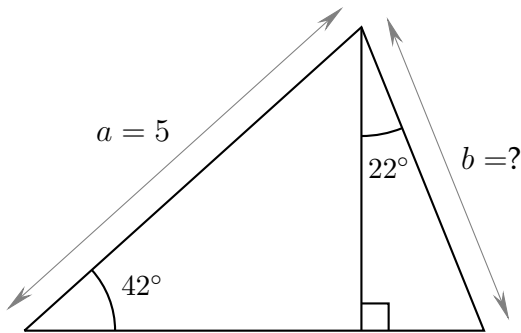7. Find all solution to the equation $(x + 3)^2 + (x - 5)(2x + 1) = x^2 + x + 6$.

8. Find all solutions to the equation $\dfrac{3}{x} - \dfrac{x}{x + 2} = 2$.
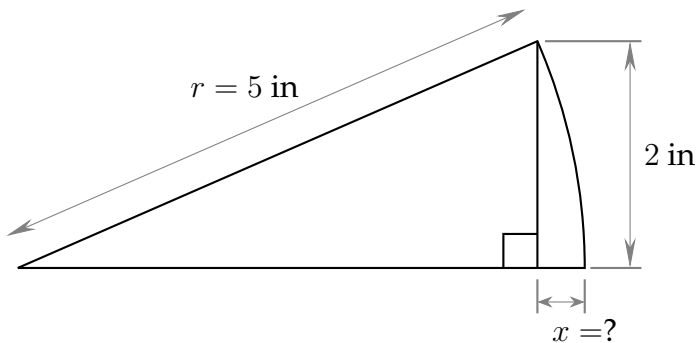
9. Find all solutions to the equation $|2x - 5| = 7$.

10. Solve the inequality $1 \leq -2x + 3 \leq 9$.

11. How many values of θ are there such that $\cos\theta = -\dfrac{1}{2}$ and $-\pi \leq \theta \leq \dfrac{3\pi}{2}$?

12. As illustrated in the picture below, a triangle is divided into two right triangles. Find the value of b.

13. As illustrated in the picture below, a vertical cut was made to a pizza slice of radius 5 inches so that the resulting right triangular piece has a height of 2 inches. Find the length, x.

14. As illustrated in the picture below, a vertical cut was made to a right triangle with base $b = 4$ and height $h = 3$. Find the area of the shaded region in terms of x.
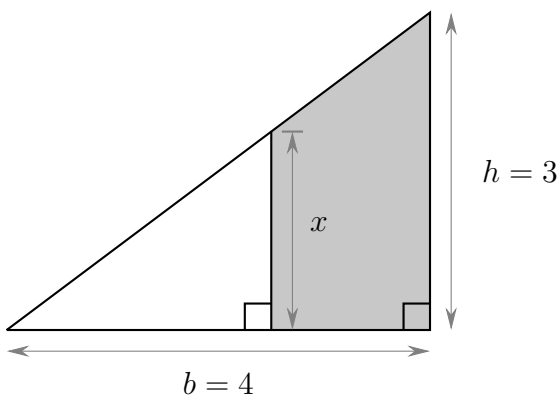
15. Suppose $f(x) = 2x + 3$. Find all solutions to the equation $4f(x + 1) = f(3x) + 2$.

16. What is the area of the triangle in the xy-plane with vertices $(-4, -2)$, $(-1, 3)$ and $(5, -2)$?

Answers

1. 40 miles

   Be able to introduce variables for unknown quantities and set up an equation in order to solve for the variable.

2. 288.

   Be able to work with quantities using ratios and percentages.

3. $y = -2x + 10$.

   Be able to find the slope of a line given two points, then find the equation of the line with point-slope or slope-intercept formula.

4. $y = -3x - 4$.

   Be able to find the slope of a line perpendicular to a given line, then find the equation of the line with slope-point or slope-intercept formula.

5. $x = \dfrac{13}{11}, y = -\dfrac{18}{11}$.

   Be able to solve systems of two linear equations with two variables by elimination or substitution.

6. $x = 1, x = \dfrac{5}{2}$.

   Be able to solve quadratic equations.

7. $x = 1 + \sqrt{2}, x = 1 - \sqrt{2}$.

   Be able to multiply out perfect squares; multiply two linear functions; simplify and solve quadratic equations.

8. $x = \dfrac{-1 + \sqrt{73}}{6}, x = \dfrac{-1 - \sqrt{73}}{6}$.

   Be able to solve equations involving rational expressions which may require solving quadratic equations.

9. $x = -1, x = 6$.

   Be able to work with an absolute value expression using the definition $|x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x < 0. \end{cases}$

10. $-3 \leq x \leq 1$.

    Be able to solve linear inequalities.

11. 3.

    Know the graph and periodicity of the functions sine and cosine.

12. $b = 3.6084...$

    Be able to apply sine and cosine of an angle to find the side length of a right triangle.

13. $x = 0.417424...$

    Be able to apply the Pythagorean Theorem to find the side length of a right triangle; be able to solve geometry problems involving circles and right triangles.

14. $A = 6 - \dfrac{2}{3}x^2$

    Be able to relate side lengths of two similar triangles by proportionality; be able to find the area of a trapezoidal region.

15. $x = -\dfrac{15}{2}$

    Be able to substitute expressions into a given function and work with the resulting expression.

16. $x = \dfrac{45}{2}$

    Be able to plot points in the xy plane and identify vertical and horizontal distances.