Algebra 1 and Geometry Proficiency Self-Assessment
for
Aspiring Algebra 2 Honors Students

Are You Really Ready for Algebra 2 Honors?

The transition from Geometry (regular or honors) to Algebra 2 Honors is a <u>very</u> challenging one. Even if you have qualified for Algebra 2 Honors by meeting the grade prerequisites, the transition and the higher level of rigor will challenge you. For starters, you will absolutely need a rock-solid foundation in the concepts of Algebra 1 and Geometry. But to truly be successful, you must have a strong enough command of these concepts to apply them in combination and in new ways. Compared to the regular version of the Algebra 2 course, the honors version is more rigorous, and the language is more formal. The demands of the Honors course are higher because it is designed to prepare students for the Precalculus Honors course.

Assessment Instructions

This self-assessment will help you measure your command of Algebra 1 and Geometry concepts and hence, your readiness for Algebra 2 Honors. It will also help you reflect on whether you <u>really</u> want to take the course. The problems here cover Algebra 1 and Geometry concepts that you have seen before. You may not initially recognize them because most of these problems call upon knowledge of multiple Algebra 1 and Geometry concepts in combination, or in a slightly new context. But as stated above, **persevering with problems like these which you may not initially know how to solve is precisely what will be demanded of you in our Algebra 2 Honors course.** The problems here also represent the typical level of rigor of the Algebra 2 Honors course.

Sometime in the next week, please find a quiet place, give yourself at least an hour and attempt to solve the problems included in this assessment. Answer them on your own, without outside help from a tutor, the web, a textbook, your friends, or any other source. For your own sake, it's important for this self-assessment to be an honest experience. **If you struggle with these problems, then it doesn't necessarily mean you shouldn't take Algebra 2 Honors. What's most important to think about is how you feel about and respond to the struggle.**

Things to Think About

After you have completed the assessment and checked your answers against the answer key provided, we ask that you take time to reflect on whether you really want to take Algebra 2 Honors. Here are a few important things to consider:

- **You Gotta Enjoy It!** If you're not enjoying the struggle with these problems, then you're not likely to enjoy Algebra 2 Honors. In Algebra 2 Honors you will be asked to do quite a bit of rigorous problem-solving every day. You'll be given some guidance, but you'll be asked to struggle and persevere more than in any other course you've taken so far. This challenge should excite you. If it doesn't then Algebra 2 Honors at best will be a grind and at worst will be a frustrating experience.

- **You Gotta Be Ready to Ask for Help!** If you wrestle with these Algebra 1 and Geometry problems and still cannot solve them then you should consider attending office hours <u>this spring</u> with your current teacher to discuss the problems and to get help. Your teacher has seen this document and is ready to talk through it with you. If you are not willing to attend office hours now, then you should consider not taking Algebra 2 Honors next year. Attending office hours will be a common and essential ingredient to success in Algebra 2 Honors.

- **You Gotta Make Time for Struggle!** If you are frustrated because the struggle with these problems is too time-consuming then Algebra 2 Honors may not be the class for you. Algebra 2 Honors will consistently present perseverance challenges that require additional time and effort and you will need to plan for both.   Essentially, if you take Algebra 2 Honors then you should plan to spend a lot more time on math next year.

- **You Gotta Want It!** It's possible—even likely—that the adjustment to the challenges of Algebra 2 Honors will take time. Your grade on the first assessment might be a "D". This happens to many qualified students. How will you react to that? Will you give up and drop or will you keep trying? You should know that most students who stay and work hard are able to raise their grade over the course of the semester. Your final grade is not determined by that first D but rather by your commitment through the semester. It's also possible that you'll work hard through the semester to finish with less than an "A".   How do you feel about that possibility? Are you willing to risk an A for the opportunity to learn math more deeply and at a higher level?

If you are not prepared for the realities described above then you should decide, <u>prior to May 1st</u>, to take Regular Algebra 2 instead. Your counselor can help you adjust your course requests until May, when requests are locked in. There is a two-week drop period at the start of the school year, **but we cannot guarantee that a drop will be feasible in the fall. It will depend on whether there is room in the regular Algebra 2 sections.** In addition, waiting to drop Algebra 2 Honors in the fall is likely to be painful. A drop in September may require changing other classes in your course schedule which would force you to leave another class that you really like.

Algebra 2 Honors is a fantastic foundational course for college math, but it is not for everyone and it is certainly not the only route to college math. **Regular Algebra 2 is also excellent preparation for college math--including STEM majors!** Students following the regular pathway have gone on to thrive in STEM majors at excellent universities. Both regular and honors will prepare you well. Ultimately, your decision whether to take Algebra 2 Honors should depend on your enthusiasm for math, your drive to persevere through struggle, and your willingness to prioritize the course by reserving extra time in your schedule next year. If you'd like to talk through any aspect of this decision, then please feel free to contact your counselor and/or your math teacher (prior to May 1st).

--The Bellarmine Math Department

ALGEBRA 1 AND GEOMETRY SELF-ASSESSMENT

FOR ASPIRING ALGEBRA 2 HONORS STUDENTS

Linear Relationships

1. Find the slope between the following two points.

a) $(3,1)$ and $(3+4t, 1+3t)$

b) $(m-5, n)$ and $(5+m, n^2)$

2. Find the values of c and d to fit the requirements below.

The rate of change of a function is -4. One point on the function is $(-2,5)$. Find the values of c and d so that the points $(c, 11)$ and $(3, d)$ lie on the function.

3. Find the missing entries in the data tables below. Describe if it is a linear or non-linear relationship and how you know.

3a)

x_1	y_1
-2	$\frac{2}{9}$
....	2
1	....
2	18
5	486
9	....

3b)

x_2	y_2
-10	8
5	....
30	-16
50	....
65	-37
....	-46

3c) Write an equation that models the relationship in 3a.

3d) Write an equation that models the relationship in 3b.

Properties of Exponents

4. It is well known that multiplication can be distributed over addition or subtraction, meaning that $a \cdot (b + c)$ is equivalent to $a \cdot b + a \cdot c$, and that $a \cdot (b - c)$ is equivalent to $a \cdot b - a \cdot c$. It is not true that multiplication distributes over multiplication, however, for $a \cdot (b \cdot c)$ is not the same as $a \cdot b \cdot a \cdot c$.

4a) Now consider distributive questions about exponents: Is $(b + c)^n$ equivalent to $b^n + c^n$? Explore this question by choosing some numerical examples.
4b) Is $(b \cdot c)^n$ equivalent to $b^n \cdot c^n$? Look at more examples.

5. Find 3 equivalent ways to rewrite (without using a calculator) the following expressions:

a) $\left(\frac{x^{\frac{1}{2}}}{y^{\frac{2}{3}}}\right)^6 \left(\frac{x^{\frac{1}{2}}}{y^{\frac{2}{3}}}\right)^{-6}$ b) $(3p^3q^4)^2$ c) $b^{\frac{1}{2}}b^{\frac{1}{3}}b^{\frac{1}{6}}$ d) $\left(\frac{2x^3}{3y^2}\right)^2$ e) $\left(\sqrt{d}\right)^6$

6. Explain your opinions of each of the following student responses:

a) Asked to find an expression equivalent to $x^8 - x^5$, a student responded x^3.
b) Asked to find an expression equivalent to $\frac{x^8-x^5}{x^2}$, a student responded $x^6 - x^3$.
c) Another student said $\frac{x^2}{x^8-x^5}$ is equivalent to $\frac{1}{x^6} - \frac{1}{x^3}$.

7. Invent a division problem whose answer is b^0, and thereby discover the meaning of b^0.

Graphing Relationships

8. Find 3 impossible inputs to each function and 3 impossible outputs.

8a) $y = \sqrt{x}$ 8b) $y = 2(x - 1)^2 - 3$ 8c) $y = -2\sqrt{3 - x} + 1$

9. Now that you have thought about possible inputs/outputs and impossible inputs/outputs sketch a graph for each of the functions above. What are their domains and ranges?

Factoring

10. Factor the following expressions.

10a) $3x^2 + 9x$ 10b) -12$x^2 + 10x + 8$ 10c) $2x + 6 - xy - 3y$

Function Notation

11. Given the functions below find the indicated values.

$g(x) = -2x^2 + 5$ $\qquad$ $h(x) = \frac{3}{2x} + 4$ $\qquad$ $s(x) = 5x - 3$

11a. $g(-3) =$ $\qquad$ 11b. $s(a-8) =$ $\qquad$ 11c. $h(4) + g(-1) =$

11d. Describe the domain and range of $h(x)$.

11e. Simplify $\big(s(x+1) - s(x)\big) - \big(s(x) - s(x+1)\big)$

System of Equations

12. Solve each of the system of equations algebraically. How many solutions did you get? How could you verify that your solution is correct?

12a) $-\frac{5}{7} - \frac{11}{7}x = -y$

$2y = 7 + 5x$

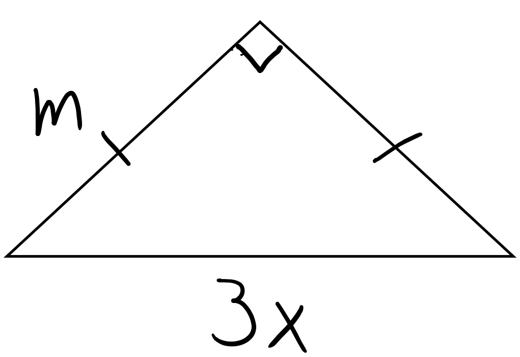
12b) $-24 - 8x = 12y$

$1 + \frac{5}{9}y = -\frac{7}{18}x$

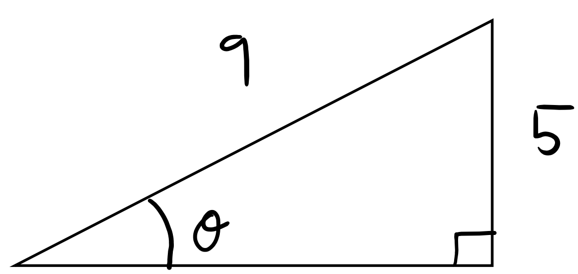
Geometry

13. Describe the set of all points k units from a point (a, b) (either graphically or algebraically) .

14. Solve for m below (might be in terms of other variables):



$\mathrm{m} = \cos\theta$



SOLUTIONS

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Solutions are bolded. Note: Not all work is shown.

Linear Relationships

1. Find the slope between the following two points.

a) $(3,1)$ *and* $(3+4t, 1+3t)$

$\boldsymbol{m = \frac{3}{4}}$

b) $(m-5, n)$ *and* $(5+m, n^2)$

$\boldsymbol{m = \frac{n^2-n}{10}}$

2. Find the values of c and d to fit the requirements below.

The rate of change of a function is -4. One point on the function is $(-2,5)$. Find the values of c and d so that the points $(c, 11)$ *and* $(3, d)$ lie on the function.

$\boldsymbol{c = -\frac{7}{2}}$ $\boldsymbol{d = -15}$

3. Find the missing entries in the data tables below. Describe if it is a linear or non-linear relationship and how you know.

3a)

x_1	y_1
-2	$\frac{2}{9}$
0	2
1	6
2	18
5	486
9	39366

exp

3b)

x_2	y_2
-10	8
5	-1
30	-16
50	-28
65	-37
80	-46

linear

3c) Write an equation that models the relationship in 3a.

$$\boldsymbol{y = 2(3)^x}$$

3d) Write an equation that models the relationship in 3b.

$$\boldsymbol{y = -\frac{3}{5}x + 2}$$

Properties of Exponents

4. It is well known that multiplication can be distributed over addition or subtraction, meaning that $a \cdot (b + c)$ is equivalent to $a \cdot b + a \cdot c$, and that $a \cdot (b - c)$ is equivalent to $a \cdot b - a \cdot c$. It is not true that multiplication distributes over multiplication, however, for $a \cdot (b \cdot c)$ is not the same as $a \cdot b \cdot a \cdot c$.

4a) Now consider distributive questions about exponents: Is $(b + c)^n$ equivalent to $b^n + c^n$? Explore this question by choosing some numerical examples.

No, let $\boldsymbol{b = 1, c = 3, and\ n = 2}$. If you assume they are equal then you get a false statement, $\boldsymbol{16 \neq 10}$.

4b) Is $(b \cdot c)^n$ equivalent to $b^n \cdot c^n$? Look at more examples.

Yes this is true for any value of b, c, and n.

5. Find 3 equivalent ways to rewrite (without using a calculator) the following expressions:

a) $\left(\frac{x^{\frac{1}{2}}}{y^{\frac{2}{3}}}\right)^6 \left(\frac{x^{\frac{1}{2}}}{y^{\frac{2}{3}}}\right)^{-6}$ b) $(3p^3q^4)^2$ c) $b^{\frac{1}{2}}b^{\frac{1}{3}}b^{\frac{1}{6}}$ d) $\left(\frac{2x^3}{3y^2}\right)^2$ e) $\left(\sqrt{d}\right)^6$

Answers are in simplest form: a) 1 b) $\boldsymbol{9p^6q^8}$ c) $\boldsymbol{b}$ d) $\boldsymbol{\frac{4x^6}{9y^4}}$ e) $\boldsymbol{d^3}$

6. Explain your opinions of each of the following student responses:

a) Asked to find an expression equivalent to $x^8 - x^5$, a student responded x^3.

This student is trying to combine terms that are not alike. Needs to review properties of exponents.

b) Asked to find an expression equivalent to $\frac{x^8 - x^5}{x^2}$, a student responded $x^6 - x^3$.

This student is correct. He used properties of exponents correctly.

c) Another student said $\frac{x^2}{x^8 - x^5}$ is equivalent to $\frac{1}{x^6} - \frac{1}{x^3}$.

This student is not correct. Order of operations was not followed when simplifying.

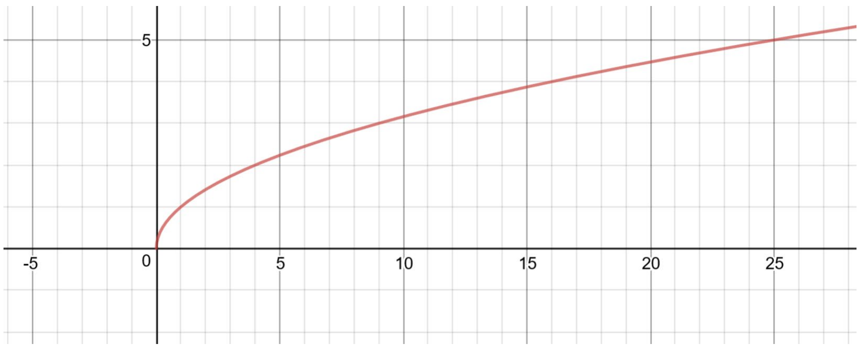
7. Invent a division problem whose answer is b^0, and thereby discover the meaning of b^0.

$$\boldsymbol{\frac{b^2}{b^2} = b^{2-2} = b^0 = 1}$$

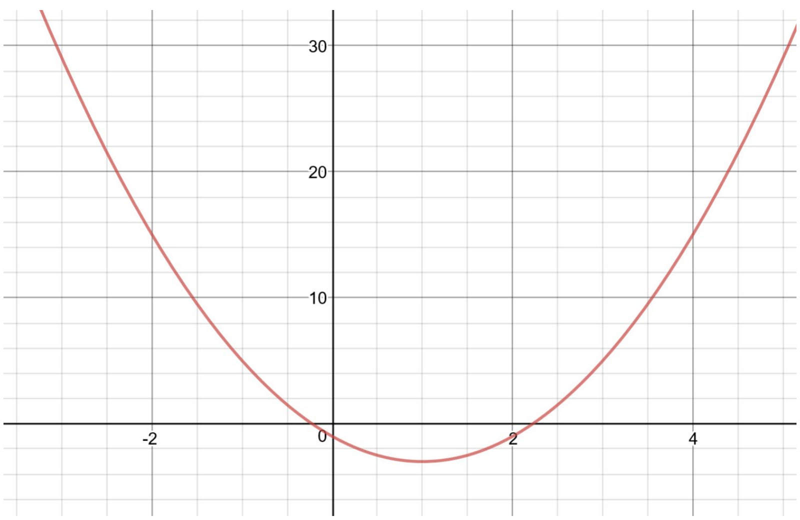
Graphing Relationships

8. Find 3 impossible inputs to each function and 3 impossible outputs.

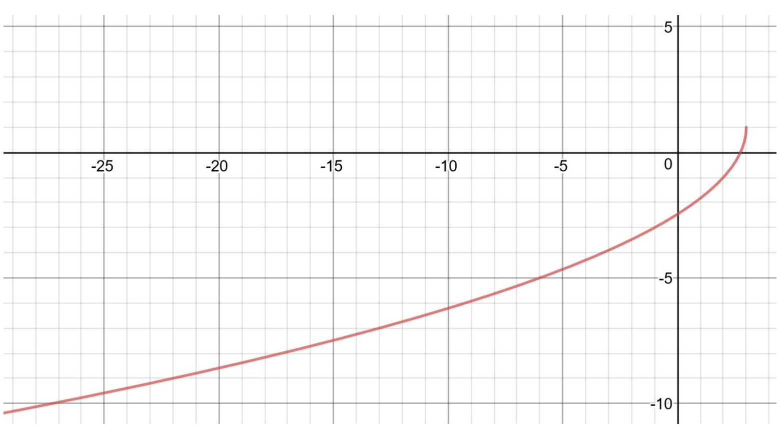
8a) $y = \sqrt{x}$ $\qquad x \neq -2, -2.7, or - 1000$



8b) $y = 2(x-1)^2 - 3$ $\qquad \boldsymbol{all\ real\ number\ inputs\ are\ possible}$

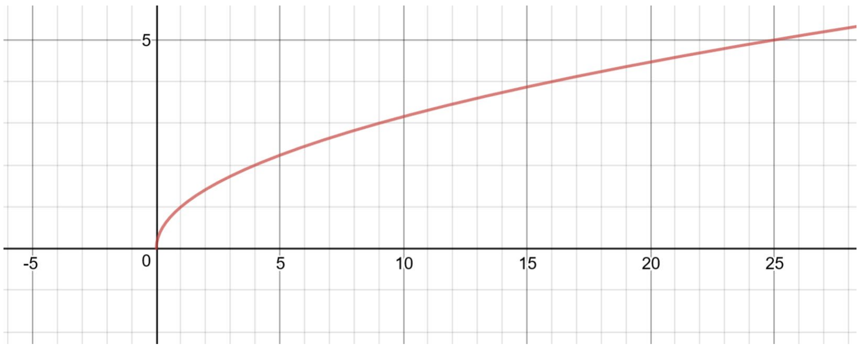


8c) $y = -2\sqrt{3-x} + 1$ $\qquad \boldsymbol{x \neq 3.0001, 4, or\ 5.5}$

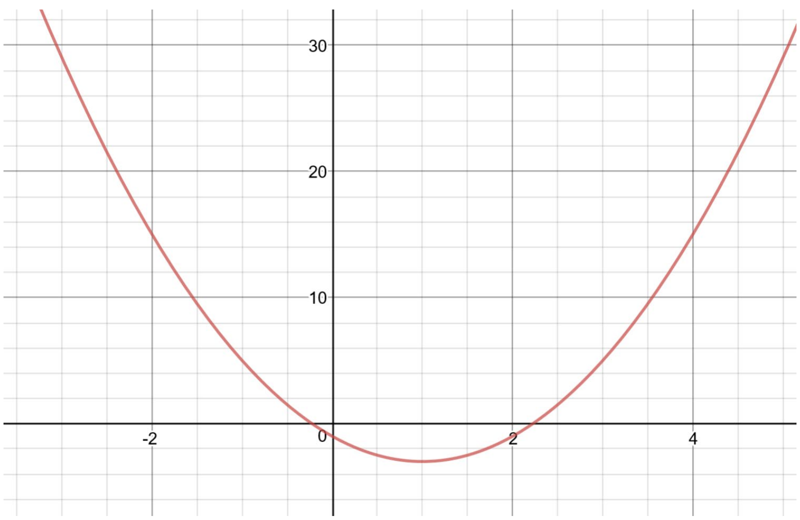


9. Now that you have thought about possible inputs/outputs and impossible inputs/outputs sketch a graph for each of the functions above. What are their domains and ranges?

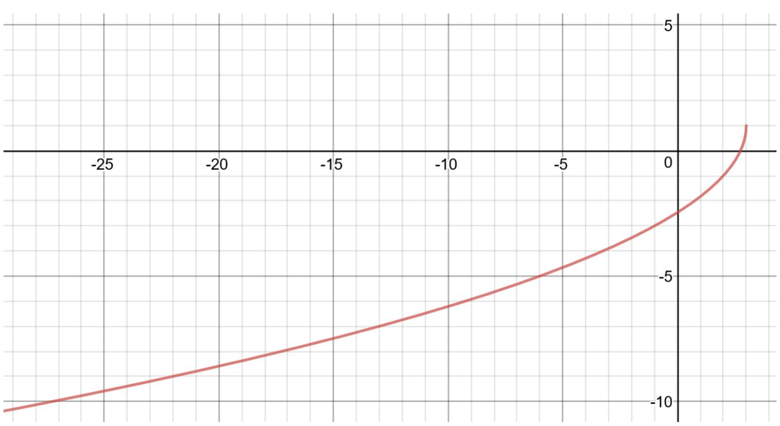
8a) $y = \sqrt{x}$ $\quad$ $\boldsymbol{D: 0 \le x < \infty \;\; or \;\; [0, \infty)}$ $\quad$ $\boldsymbol{R: 0 \le y < \infty \;\; or \;\; [0, \infty)}$



8b) $y = 2(x-1)^2 - 3$ $\quad$ $\boldsymbol{D: -\infty \le x < \infty \;\; or \;\; [-\infty, \infty)}$ $\quad$ $\boldsymbol{R: -3 \le y < \infty \;\; or \;\; [-3, \infty)}$



8c) $y = -2\sqrt{3-x} + 1$ $\quad$ $\boldsymbol{D: -\infty \le x < 3 \;\; or \;\; [-\infty, 3)}$ $\quad$ $\boldsymbol{R: -\infty \le y < 1 \;\; or \;\; [-\infty, 1)}$



Factoring

10. Factor the following expressions.

10a) $3x^2 + 9x$

$\mathbf{3x(x+3)}$

10b) -12$x^2 + 10x + 8$

$\mathbf{-2(3x+4)(2x+1)}$

10c) $2x + 6 - xy - 3y$

$\mathbf{(x+3)(2-x)}$

Function Notation

11. Given the functions below find the indicated values.

$g(x) = -2x^2 + 5$ $\quad$ $h(x) = \frac{3}{2x} + 4$ $\quad$ $s(x) = 5x - 3$

11a. $g(-3) = \mathbf{-13}$

11b. $s(a-8) = \mathbf{5a - 43}$

11c. $h(4) + g(-1) = \mathbf{\frac{59}{8}}$

11d. Describe the domain and range of $h(x)$. $\boldsymbol{D}: (-\infty, \mathbf{0})\boldsymbol{U}(\mathbf{0}, \infty)$ $\boldsymbol{R}: (-\infty, \mathbf{4})\boldsymbol{U}(\mathbf{4}, \infty)$

11e. Simplify $\big(s(x+1) - s(x)\big) - \big(s(x) - s(x+1)\big) = \mathbf{2[\boldsymbol{s}(\boldsymbol{x}+1) - \boldsymbol{s}(\boldsymbol{x})]}$

$= \mathbf{2[5(\boldsymbol{x}+1) - 3 - (5\boldsymbol{x} - 3)]}$

$= \mathbf{10}$

System of Equations

12. Solve each of the system of equations algebraically. How many solutions did you get? How could you verify that your solution is correct?

12a) $-\frac{5}{7} - \frac{11}{7}x = -y$

$2y = 7 + 5x$

These lines intersect at $\mathbf{(-3, -4)}$.

We could verify by graphing both equations and looking for the intersection points.

12b) $-24 - 8x = 12y$

$1 + \frac{5}{9}y = -\frac{7}{18}x$

These lines intersect at $\mathbf{(6, -6)}$.

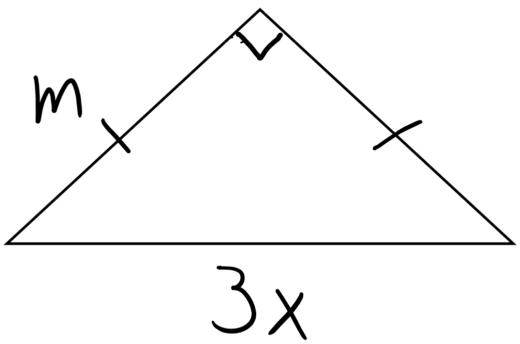
We could also verify that the solution makes each equation true.

Geometry

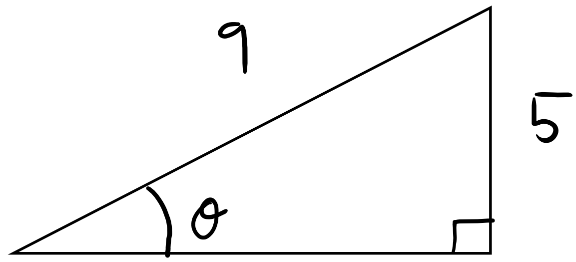
13. Describe the set of all points k units from a point (a, b) (either graphically or algebraically) .

The set of all points $\boldsymbol{k}$ units from a point $(\boldsymbol{a}, \boldsymbol{b})$ would form a circle.

14. Solve for m below (might be in terms of other variables):



$\mathrm{m} = \cos\theta$



$\boldsymbol{m = \frac{3x\sqrt{2}}{2}}$

$\boldsymbol{m = cos\left(\frac{2\sqrt{14}}{9}\right)}$