

# Rigor

Task Handout, Algebra 1

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“A social justice priority in mathematics education is to openly challenge deficit thinking and the institutional tools and practices that perpetuate static views about children and their mathematics competencies. Eliminating the deficit discourse by focusing on learning rather than labels is a key step toward a more just and equitable mathematics education.” —*National Council of Supervisors of Mathematics and TODOS: Mathematics for All*

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# Conceptual Understanding Task #1

## Task

The Zero Product Property states that if the product of two numbers is zero, then at least one of the numbers is zero. In symbols, where  $a$  and  $b$  represent numbers, if  $ab = 0$ , then  $a = 0$  or  $b = 0$ . The steps below provide a proof of this property starting with the equation  $ab = 0$ .

- If  $a = 0$ , then the property is true. Explain.
- Assume that  $a \neq 0$ . Then  $a$  has a reciprocal. Explain.
- Since  $a$  has a reciprocal, we can multiply both sides of the equation by  $\frac{1}{a}$ . What effect does this move have on the left side of the equation? On the right side of the equation?
- Explain why these steps prove the Zero Product Property.

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# Conceptual Understanding Task #2

## Task

A certain business keeps a database of information about its customers.

- a. Let  $C$  be the rule which assigns to each customer shown in the table his or her home phone number. Is  $C$  a function? Explain your reasoning.

Customer Name	Home Phone Number
Heather Baker	3105100091
Mike London	3105200256
Sue Green	3234132598
Bruce Swift	3234132598
Michelle Metz	2138061124

- b. Let  $P$  be the rule which assigns to each phone number in the table above, the customer name associated with it. Is  $P$  a function? Explain your reasoning.
- c. Explain why a business would want to use a person's social security number as a way to identify a particular customer instead of their phone number.

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# Procedural Skills and Fluency Task #1

## Task

In each of the equations below, rewrite the equation, solving for the indicated variable

- a. If  $F$  denotes a temperature in degrees Fahrenheit and  $C$  is the same temperature measured in degrees Celsius, then  $F$  and  $C$  are related by the equation

$$F = \frac{9}{5}C + 32.$$

Rewrite this expression to solve for  $C$  in terms of  $F$ .

- b. The surface area  $S$  of a sphere of radius  $r$  is given by

$$S = 4\pi r^2.$$

Solve for  $r$  in terms of  $S$ .

- c. The height  $h$  of a diver over the water is modeled by the equation

$$h = -5t^2 + 8t + 3$$

where  $h$  denotes the height of the diver over the water (in meters) and  $t$  is time measured in seconds. Rewrite this equation, finding  $t$  in terms of  $h$ .

- d. A bacteria population  $P$  is modeled by the equation

$$P = P_0 10^{kt}$$

where time  $t$  is measured in hours,  $k$  is a positive constant, and  $P_0$  is the bacteria population at the beginning of the experiment. Rewrite this equation to find  $t$  in terms of  $P$ .

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## Procedural Skills and Fluency Task #2

1. A rectangle with positive area has length represented by the expression  $3x^2 + 5x - 8$  and width by  $2x^2 + 6x$ . Write expressions in terms of  $x$  for the perimeter and area of the rectangle. Give your answers in standard polynomial form and show your work.

a. Perimeter:

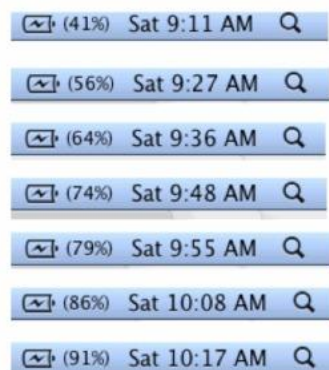
b. Area:

Source: EngageNY.org of the New York State Education Department. Algebra 1, Module 4, Mid-Module Assessment. Available from <https://www.engageny.org/resource/algebra-i-module-4/file/117626> accessed 26 May 2018. Licensed by EngageNY under CC BY-NC-SA 3.0.

# Application Task #1

## Task

Jerry forgot to plug in his laptop before he went to bed. He wants to take the laptop to his friend's house with a full battery. The pictures below show screenshots of the battery charge indicator after he plugs in the computer.



- When can Jerry expect that his laptop battery is fully charged?
- At 9:27 AM Jerry makes a quick calculation:

***The battery seems to be charging at a rate of 1 percentage point per minute. So the battery should be fully charged at 10:11 AM.***

Explain Jerry's calculation. Is his estimate most likely an under- or over-estimate? How does it compare to your prediction?

- Compare the average rate of change of the battery charging function on the first given time interval and on the last given time interval. What does this tell you about how the battery is charging?
- How long would it take for the battery to charge if it started out completely empty?

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# Application Task #2

## Task

It takes Clea 60 seconds to walk down an escalator when it is not operating, and only 24 seconds to walk down the escalator when it is operating. How many seconds does it take Clea to ride down the operating escalator when she just stands on it?

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