**Animal Populations**

Algebra –SSE

*Original problem from illustrativemathematics.org*

Suppose P and Q give the sizes of two different animal populations, where Q > P. In (a) – (d), say which of the expressions is larger. Briefly explain your reasoning in terms of the two populations.

(a) *P*  +  *Q* and 2*P*

(b) (*Q – P*)/2 and *Q – P*/2

(c) $\frac{P}{P+Q}$ and $\frac{P+Q}{2}$

(d) *P*  + 50*t* and *Q*  + 50*t*

**Animal Populations**

Additional questions: Focus on proportional reasoning and scalar multiplication.

Recall that *P* and *Q* represent the size of two different animal populations, where *P* < *Q*.

Which expression is larger? How do you know?

(e) 3*P* and 3*Q*

(f) 2*Q* and 3*P*

(g) $\frac{Q}{P}$ and $\frac{P}{Q}$

(h) - *Q*  and – *P* (may not have a reasonable interpretation in this problem context)

**Extension questions:**

Recall P and Q are the sizes of different animal populations. What might $\frac{P}{P+Q}$ and $\frac{P+Q}{2}$ represent?

Find another way to justify your answer to (b) and (c).

On a number line, draw 0, *P*, and *Q.* Show on the number line as many of the quantities (expressions) as you can from the following list:

2*P*

$$\frac{P+Q}{2}$$

(*Q – P*)/2

 –(*Q* + *P*)

In this scenario, P and Q are positive integers. (If you haven’t already, think about why that is.) Suppose instead that P and Q could be any real number where P < Q. Which answers for (a) – (d), if any, would that change?

(Abstract question) Which operations – addition, subtraction, multiplication, division, squaring, square rooting, exponentiation – preserve the relative relationship of P and Q? You might consider this question for both positive integer values of P and Q, and then real P and Q.

**HINT CARDS**

Pick a population value for *P* and pick a larger value for *Q*.

Plug in the population values to the expressions and compare.
Consider other values. What seems to be true?

Compare *P* + *P* , *P* + *Q*, *Q* + *Q*

Which is the largest? How do you know?

*Modified and extended from illustrativemathematics.org*

*A-SSE Animal Populations -- Alignment with A-SSE.A.1 and A-SSE.A.2*

**Interpret the structure of expressions** (Cluster)

A- SSE.A.1 Interpret expressions that represent a quantity in terms of its context.

 -Interpret parts of an expression, such as terms, factors, and coefficients.

-Interpret complicated expressions by viewing one or more of their parts as a single entity.

A-SSE.A.2 Use the structure of an expression to identify ways to rewrite it.

See illutrativemathematics.org for Commentary