

## 2.1 and 2.2 Exercises:

1. Write a one page essay on the Irrational number  $e$  using the internet as your resource. Be sure to get about 7 decimal places on the nearby Rational number that is close to  $e$ .

Perform the following operations (without using a calculator !) and tell which set or sets the answer belongs to:

2.  $3.17 + .38 - .55$

3.  $5\frac{1}{7} \div 2\frac{1}{3}$

4.  $-\frac{\pi}{12} + \frac{\pi}{3} - \frac{\pi}{4}$

5.  $(\sqrt{2})^4$

6.  $-\sqrt{144}$

7.  $\sqrt{6} + \sqrt{7}$

8.  $3\pi - \sqrt{25}$

Find a representation for the following numbers that show the number is a Rational number (do not use a calculator):

9.  $-\sqrt{169}$

10.  $(3)^2$

11.  $\frac{1}{3} - \frac{2}{5}$

12.  $\frac{3}{14} \cdot 2\frac{1}{3}$

13.  $\sqrt{3}(\sqrt{12})$

14. 0

15.  $\frac{4\pi}{\pi}$

16.  $11\frac{1}{5}$

17.  $-2\frac{2}{5}$

Rewrite the following numbers as decimals without using a calculator:

18.  $5\frac{1}{3}$

19.  $-\frac{1}{7}$

20.  $\frac{3}{5}$

21.  $-\frac{1}{12}$

Find examples of the following numbers. If there is no such number, say so.

22. A Real number that is not a Rational number.

23. A Rational number that is not an Integer.

24. A Natural number that is not a Whole number.

25. A Rational number that is also an Integer.

26. An Irrational number that is smaller than 0.

27. An Integer that is not a Rational number nor a Whole number.

28. An Irrational number that is a terminating decimal.

29. A number that is strictly Rational.

Given the following vocabulary, tell which words apply to each element in the given sets.

Natural, Whole, Integer, Rational, Irrational, Real

30.  $\{ .01\overline{33}, \sqrt{11}, -\frac{1}{3}, -\sqrt{25}, \frac{0}{-17}, 2, 0.1 \}$

31.  $\{ -2, \frac{1}{\sqrt{4}}, -0.\overline{0}, 5, \pi, \frac{\sqrt{7}}{2}, \frac{9}{0}, 17 \}$

32.  $\{ 17, -17, \sqrt{17}, \frac{1}{17}, 17^2, 0.17 \}$

33. Why can't you divide by zero? Well, the simple answer is that nobody can figure out what it means to do so. There are basically 2 explanations of what it means to divide by zero and they are contradictory.

Explanation 1 is very straight forward. 0 means nothing; if you divide by 0 you are dividing by nothing and the numerator should be unchanged. So, with this argument  $\frac{5}{0} = 5$ . There's some intuitive appeal to this argument.

Explanation 2 requires some work. First let's discuss the number line. If you are at 5 and you move a little to the right then you are at 5.01 or 5.02 or 5.1 or 5.15. These numbers round to 5 and could be called 5-ish. And if you move to the left just a little bit, you are at 4.89, 4.99; again, numbers that are close to 5 and could be called 5-ish.

Now let's look at  $5 \div 2$  in it's decimal representation: 2.5.

Fill in the following table and note that in all cases you get 2.5-ish answers when you divide 5 by a 2-ish number.

2-ish number	$5 \div 2\text{-ish number}$	Close to 2.5?
$2\frac{1}{100}$		
2.0001		
$1\frac{99}{100}$		
1.967		

Now by explanation 1, dividing 5 by zero changes nothing. So dividing 5 by a number that is close to zero (z-ish) you should get an answer that is 5-ish, right?

Fill in the following table and see what you think about this argument now.

Z-ish number	$5 \div z\text{-ish number}$	How close to 5?
$\frac{1}{100}$		
.00001		
$-\frac{1}{1000}$		
-.0001		

Not only is the answer not-5-ish...the answers aren't even close to each other!  
Now any reasonable definition of what it means to divide by zero has to match what happens when people divide by zero-ish numbers, too.

This is the real problem: how can you say that an arithmetic process that works for non-zero numbers comes up with a different answer than a reasoning process for the same mathematical behavior when we're talking about zero?

Write a one page summary of our work here that shows that you understand why it's not possible to talk about what dividing by zero means.

Use a calculator and get an approximate answer to each computation that is 3 decimal places long.

34.  $\frac{\pi}{5} + .01001000100001\dots$

35.  $\frac{\sqrt{6}}{\sqrt{17}}$

36.  $e + 2$

37.  $\sqrt{3} - 2\sqrt{10}$

38.  $\sqrt{\pi}$

39.  $3\pi - \sqrt{2}$

40.  $\frac{1}{\sqrt{5}}$