A Prime Investigation with 7, 11, and 13

ID: 13344

Time required
45 minutes

Activity Overview

In this activity, students will investigate the divisibility of 7, 11, and 13 and discover the divisibility characteristics of certain six-digit numbers. They will use the Integer Division feature of the TI-73 Explorer.

Topic: Numbers and Operations

- *Use factors, multiples, prime factorization, and relatively prime numbers to solve problems*

Teacher Preparation and Notes

- *Prior to beginning this activity, students should have learned the divisibility tests for the prime numbers 2, 3, and 5.*
- *Students should be familiar with the term remainder and what it represents.*
- *TI-Navigator is not required for this activity, but an extension is given for those teachers that would like to use it.*
- ***To download the student worksheet and TI-Navigator files, go to education.ti.com/exchange and enter "13344" in the quick search box.***

Associated Materials

- *MGAct04_Prime_worksheet_TI73.doc*
- *MGAct04_Prime_Nav_TI73.act*
- *MGAct04_Prime_LrnChk_TI73.edc*

Suggested Related Activities

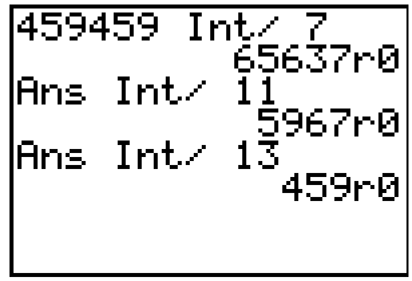
To download the activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Prime Investigation of 7, 11, and 13 (TI-73 Explorer) — 4473*
- *Priming the Numbers (TI-73 Explorer) — 8452*
- *Prime Factorization, GCF, and LCM (TI-73 Explorer & TI-Navigator) — 10465*

Problem 1 – Divisible by 7, 11, and 13?

Students will explore divisibility by 7, 11, and 13 using the [INT÷] feature. The part after the **r** is the remainder, if one exists. It will display a 0, if one does not exist.

Questions 1-4



Have students work in small groups throughout the activity. Each student should pick a unique number to work with throughout the problem.

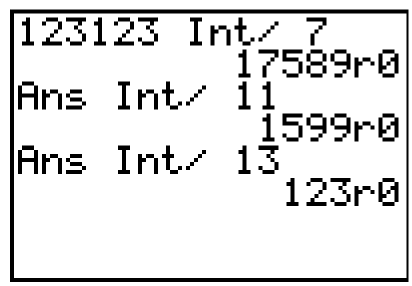
Once students have picked a six-digit number, have them enter this on a clear home screen. Then, press [2nd] [÷] [7] [ENTER]. As you can see, the answer is shown with the quotient and remainder.

If student have not worked with the [INT÷] feature before, you may want to spend a little time with smaller numbers so they understand how the function works.

If students have correctly created their six-digit number, they should find that all three division steps results in no remainder.

Problem 2 – Justify Divisibility

Questions 7-9



Again, have students work in small groups. Each student should pick a unique number to work with throughout the problem.

Again, their six-digit number (*abc*,*abc*) should be divisible by 7, 11, and 13.

Questions 10-14

As students explore the different relationships, encourage conversation and discussion around the reasons behind what is happening.

Students should see that when they multiply their original 3-digit number (*abc*) by ($7 \times 11 \times 13$), that they end up with the original 6-digit number (*abc*,*abc*).

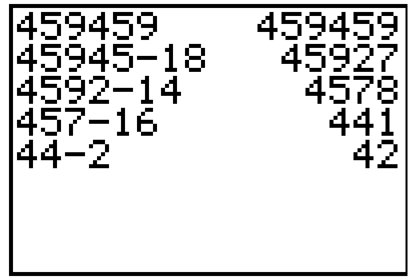
Problem 3 – Divisibility Tests

Questions 15-16

In case students do not remember the divisibility tests for 2, 3, and 5, they are given below. Direct conversation to help them recall these rules.

- A number is divisible by 2 if it is even or if the ones digit is 0, 2, 4, 6, or 8.
- A number is divisible by 3 if the sum of the digits are divisible by 3.
- A number is divisible by 5 if the ones digit is a 0 or a 5.

Make sure that students see that they start each new step with the number that was created in the previous step, not the original number from the previous step. This part of the process may initially be confusing to students.



<u>Questions 17-22</u>

Having students explore the 11 divisibility rule exposes them to additional number theory. This is a bit of trivia that is really not needed if a calculator is readily available.

The last question should spark lots of discussion among the students' groups. If they quickly come up with a rule for divisibility by 1001, you can have them revisit the rules for 2, 3, 5, 7, or 11 and see if they can find a counterexample.

Extension – TI-Navigator™

1. For Problem 1 you can have students load the six-digit numbers used by their group into a list for the class to share. Load the activity settings file ***MGAct04_Prime_Nav_TI73.act*** into Activity center. Start the activity when students are ready to submit the numbers used by their group. After all data points have been received from the students the data can be sent back out to all students. Stop the activity, click on **Configure** and click the button for "**Existing Activity List**". This will send the class set of data back to all students.
2. Use **Screen Capture** to monitor student activity throughout the lesson.
3. As an assessment, send ***MGAct04_Prime_LrnChk_TI73.edc*** to students as an evaluation. This LearningCheck™ file evaluates student understanding of divisibility rules.

Solutions – student worksheet

Problem 1

1. Answers will vary.
2. Yes, students' numbers should be divisible by 7.
3. Yes, students' numbers should be divisible by 11.
4. Yes, students' numbers should be divisible by 13. The new quotient is the original 3-digit number. No, the order of division will not change the outcome.
5. Everyone's number should be divisible by 7, 11, and 13.
6. If you multiply $7 \times 11 \times 13$ you get 1001 and if you take 1001 times any three-digit number you get a six-digit number where the original three-digit number repeats. Therefore, the original six-digit number would be divisible by 1001 or 7, 11, and 13.

Problem 2

7. Answers will vary.
8. Yes, students' numbers should all be divisible by 7, 11, and 13.
9. The six-digit number (*abc*,*abc*) should be divisible by 7, 11, and 13.
10. 1,001
11. The original six-digit number – *abc*,*abc*. It is the same.
13. $abc \times 1001 = abc \times (1000 + 1)$

$$= abc \times 1000 + abc \times 1$$
$$= abc{,}000 + abc$$
$$= abc{,}abc$$

14. Since $468{,}468 = 468 \times 1001$ and $1001 = 7 \times 11 \times 13$ then 468,468 is divisible by 7, 11, and 13.

Problem 3

15. A number is divisible by 2 if it is even or if the ones digit is 0, 2, 4, 6, or 8. A number is divisible by 3 if the sum of the digits is divisible by 3. A number is divisible by 5 if the ones digit is a 0 or a 5.
17. Yes, it should show that the original number is divisible by 7.
20. Yes, it should show that the original number is divisible by 11.
21. No. Since $8 + 2 + 4 = 14$ and $5 + 3 + 5 = 13$ and $14 - 13 = 1$ and 1 is NOT divisible by 11, then 852,345 is not divisible by 11.
22. Answers will vary. Check student's work. A six-digit number is divisible by 1001 if it is in the form *abc*,*abc*.