MATH TODAY™
Teacher Edition
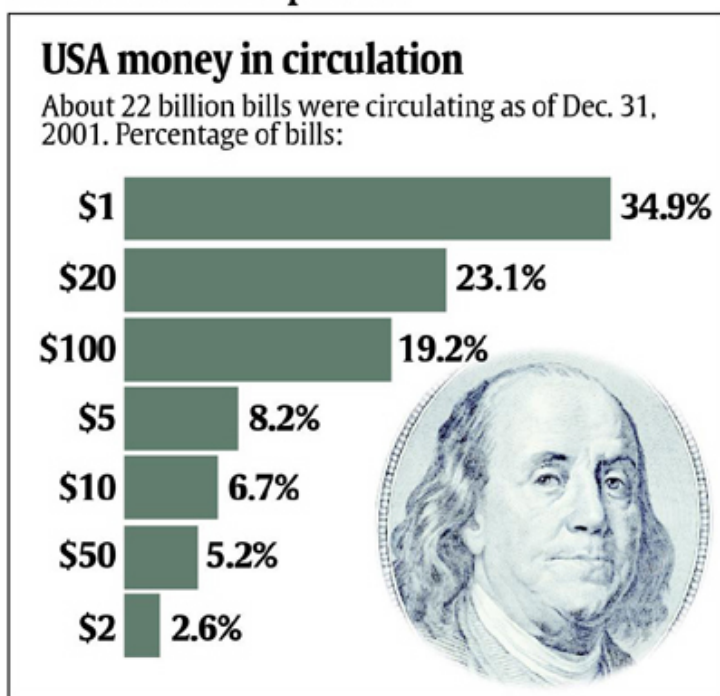
USA TODAY
NO. 1 IN THE USA
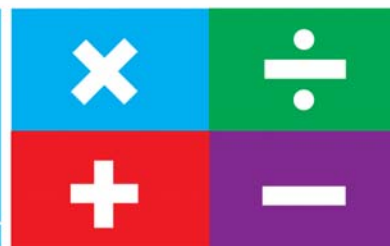
Activity 1:

USA money in circulation

by: Bob Tower

USA TODAY Snapshots®

USA money in circulation

About 22 billion bills were circulating as of Dec. 31, 2001. Percentage of bills:

Bill	Percentage
$1	34.9%
$20	23.1%
$100	19.2%
$5	8.2%
$10	6.7%
$50	5.2%
$2	2.6%

Source: Federal Reserve

By Sarah Renner and Quin Tian, USA TODAY

Activity Overview:

Students will determine the approximate number of $20 bills in circulation as of December 31, 2001, using percent and total number of bills from the USA TODAY Snapshot"USA money in circulation." Students will write their answers in decimal and scientific notation. The Science Tools App will be used to convert from one unit of measure to another.

Concepts:

- Scientific notation
- Percent of a number
- Volume of rectangular solid
- Unit conversion
- Reading and interpreting graphs

Activity at a Glance:

- Grade level: 9-12
- Subject: Algebra
- Estimated time: 50 minutes

Materials:

- TI-Navigator™ Classroom Learning System
- TI-83 Plus family or TI-84 Plus family
- ScienceTools App

Optional:

- Multimedia Projector
- TI Keyboards

Prerequisites:

- Write numbers in scientific notation
- Use the Science Tools App for unit conversion
- Convert from one unit of measure to another unit
- Find the volume of a rectangular solid

TI **navigator**

For use with the TI-Navigator™ Classroom Learning System

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Student Objectives:

- Express numbers in scientific notation.
- Determine the percent of a number.
- Convert from one unit of measure to another.
- Determine the volume of a rectangular solid.

Background:

The USA TODAY Snapshot "USA money in circulation" gives the student the opportunity to use scientific notation with real-life data. The student will work with large numbers when determining the height of a stack of $20 bills. Unit conversion will be used to change from inches to miles and cubic inches to cubic feet.

Focus Questions:

- According to the USA TODAY Snapshot "USA money in circulation," about how many $20 bills were in circulation as of December 31, 2001?
- What would be the height (measured in miles) of a single stack of all of the $20 bills in circulation as of December 31, 2001?
- What is the minimum volume of a room that could store, at one time, all of the $20 bills in circulation as of December 31, 2001?

Preparation:

- Setup your TI-Navigator™ Classroom Learning System
- Make sure you are familiar with the following functions: Send to Class, Collect from Class, Screen Capture, Quick Poll and Activity Center
- Your students will need a TI-83 Plus or TI-84 Plus graphing calculator, either working in pairs or individually
- Download the activity resource files to your computer from the Activity CD
- Recommendations:
  o Multimedia Projector for sharing the Activity Center with your students
  o TI Keyboards for students to easily answer the LearningCheck™ assessment questions

Additional Resources:

See the Preface for classroom management tips and Appendix A for information on TI-Navigator.

Data Source:

Federal Reserve

Activity Extension:

- Have students interview a local bank officer to determine how many $20 bills are maintained in that bank for normal daily transactions.
- Determine the range of dimensions of a room with a volume equivalent to the volume of all of the $20 bills found in Step 4 of the student activity. Discuss the advantages and disadvantages of the different rooms.
- Have students call a contractor to find the average cost per square foot for office space. Determine the approximate expense for a building to hold all the $20 bills in circulation as of Dec. 31, 2001. Compare that to the average monthly cost per square foot for renting storage space.
- Encourage students to explore www.usatoday.com for articles related to the new $20 bill and summarize the information in their journals or write a short related story.
- Use the Money section of USA TODAY and have students find five articles that include dollar amounts that are in the millions or higher and make a poster for the classroom..
- Ask your administrator for the dimensions of the school and have students determine if the number of $20 bills would fit in your school.

Curriculum Connection:

- Tech classes: building industry standards and building expense
- Business classes: expense reports and business plans

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Teacher: **Student:**

Activity:

The following steps represent a suggested Navigator classroom procedure to answer the focus questions.

Steps:

1. Calculator – determine the number of $20 bills in circulation based on Snapshot data
2. Quick Poll - Open Response, in decimal notation what are the number of $20 bills that were in circulation?
3. Quick Poll - Open Response, in scientific notation what are the number of $20 bills that were in circulation?
4. Calculator - calculate the number of $20 bills needed to make a stack one inch thick?
5. Quick Poll - Multiple Choice, what are the number of $20 bills needed to make a stack one inch thick?
6. Calculator - calculate how many inches thick a stack would be if it contained all the $20 bills in circulation
7. Screen Capture - check student understanding
8. Calculator – find the volume of the rectangular solid formed by a single $20 bill and find the minimum volume in cubic inches of a room that could store all of the $20 bills in circulation.
9. Screen Capture – check student understanding
10. ScienceTools App - 1) convert the answer to cubic feet
11. Screen Capture - check student understanding
12. Optional: LearningCheck Assessment with Send to/Collect From Class and the Class Results Slide Show
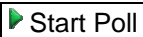   *See below for details on each of these steps.*

Focus Questions:

*   According to the USA TODAY Snapshot "USA money in circulation," about how many $20 bills were in circulation as of December 31, 2001?
*   What would be the height (measured in miles) of a single stack of all of the $20 bills in circulation as of December 31, 2001?
*   What is the minimum volume of a room that could store, at one time, all of the $20 bills in circulation as of December 31, 2001?
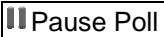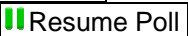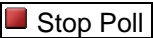
STEP 1 – CALCULATOR

1. Instruct your students to use their calculators to determine the number of $20 bills in circulation based on Snapshot data (use two significant digits for the answer)

2. Instruct your students to return to TI-Navigator when you are ready to continue the activity

1. Look at the Snapshot to find the percentage of $20 bill in circulation and the total number of bill in circulation to determine the total number of $20 bills.
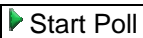
2. Press APPS and select NavNet

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$\times \div + -$

Teacher:	**Student:**

STEP 2 – QUICK POLL

1. From the pull-down menu select "Open Response" and check Resubmit so that students may change their answers
2. Press ▶ Start Poll when you are ready to start
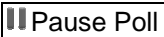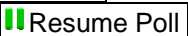3. Instruct the class to answer this question:
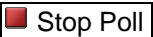
   **In decimal notation what are the number of $20 bills that were in circulation?**

4. Discuss with your class to check for understanding

    NOTE: You may select ‖Pause Poll to have a class discussion then select ‖Resume Poll to continue

5. Press ■ Stop Poll when you are ready to continue the activity

Student:
1. Students input their answers and press SEND (Y=)
2. They may resubmit their answers during the class discussion

STEP 3 – QUICK POLL

1. From the pull-down menu select "Open Response" and check Resubmit so that students may change their answers
2. Press ▶ Start Poll when you are ready to start
3. Instruct the class to answer this question:

    in scientific notation what are the number of $20 bills that were in circulation?

4. Discuss with your class to check for understanding

    NOTE: You may select ‖Pause Poll to have a class discussion then select ‖Resume Poll to continue

5. Press ■ Stop Poll when you are ready to continue the activity

Student:
1. Students input their answers and press SEND (Y=)
2. They may resubmit their answers during the class discussion

STEP 4 – CALCULATOR

1. Instruct your students to use their calculators to determine the number of $20 bills needed to make a stack one inch thick.

Student:
1. The U.S Bureau of Engraving and Printing lists the dimensions of existing currency is 2.61" wide, 6.14" long, and 0.0043 inches thick. Use this information to determine how many $20 bills are needed to make a stack one inch thick.

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Teacher: **Student:**

STEP 5 – QUICK POLL
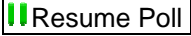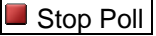
1. From the pull-down menu select "Multiple Choice A Thru C" and check Resubmit so that students may change their answers
2. Press ▶ Start Poll when you are ready to start
3. Instruct the class to mark and send A, B, or C to answer this question:

   What is the number of $20 bills needed to make a stack one inch thick?
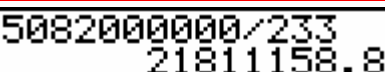   **A) 100**
   B) 233 (correct answer)
   C) 2330

4. Discuss with your class to check for understanding
   NOTE: You may select ❚❚ Pause Poll to have a class discussion then select ❚❚ Resume Poll to continue
5. Press ■ Stop Poll when you are ready to continue the activity

1. Students mark their answer A, B or C and press SEND (Y=)
2. They may resubmit their answers during the class discussion

STEP 6 – CALCULATOR

1. Instruct your students to use their calculators to determine how many inches thick a stack would be if it contained all the $20 bills in circulation.

1. Use your answer from Step 1 and Step 4 to determine this answer.

STEP 7– SCREEN CAPTURE

1. Use Screen Capture to check student understanding.
   The student calculators should look like the image on the right. If not, this is an opportunity to discuss the appropriate method to calculate this value. This would be the time to discuss rounding and/or significant digits.

```
5082000000/233
          21811158.8
```

STEP 8 – CALCULATOR

1. Find the volume of the rectangular solid formed by a single $20 bill and the minimum volume in cubic inches or a room that could store all the $20 bills in circulation.

1. Make your calculations on the home screen and wait for teacher directions.

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Teacher: **Student:**

STEP 9 – SCREEN CAPTURE

```
2.61*6.14*0.0043
              .06890922
Ans*5100000000
            351437022
```

1. Use Screen Capture to check student understanding.
    The student calculators should look like the image on the right. If not, this is an opportunity to discuss finding volume of a rectangular solid.. Using 2 significant digits the volume is 350,000,000.

STEP 10 – CALCULATOR - SCIENCETOOLS

Instruct your students to use the ScienceTools App to convert the volume to cubic feet

1. Press APPS and select SciTools
2. Select UNIT CONVERTER and VOLUME
3. Enter your value from Step 9

STEP 11 – SCREEN CAPTURE

```
         VOLUME
cm³   mL    L      m³   tsp
tbsp  in³   ozuk oz     cup
pt    qt    gal galuk ft³
3.5E8 in³▸
      2.025463E5 ft³
[CONSTANT][EXPT][COPY][EDIT]
```

1. Use Screen Capture to check student understanding.
    The student calculators should look like the image on the right. If not, this is an opportunity to discuss using the appropriate values and Science Tools App..

2. Instruct your students to return to TI-Navigator when you are ready to continue the activity

1. Press APPS and select NavNet

STEP 12 – ASSESSMENT AND EVALUATION

Access your students' understanding by using Send to Class, LearningCheck™ and Class Analysis

1. Using 👥Send to Class, distribute the LearningCheck assessment file (MT_Money_1.edc) to your students using "Force send to students now"

2. Prompt them to open the ☑LearningCheck assignment and answer the following questions:

    Q. According to the USA TODAY Snapshot "USA money in circulation," about how many $20 bills were in circulation as of December 31, 2001?

    A. About 5,100,000,000

    Q. What would be the height (measured in miles) of a single stack of all of the $20 bills in circulation as of December 31, 2001?

    A. About 350 miles

1. From the TI-Navigator Home screen press [2] Network Apps
2. Select LearnChk
3. Select the MT Money 1 assignment and follow the prompts to answer the question (TI Keyboards may be used)

Teacher: **Student:**

Q. What is the minimum volume of a room that could store, at one time, all of the $20 bills in circulation as of December 31, 2001?

A. About 200,000 cubic feet or 2.0×10^5 (two significant digits accuracy)

3. Select ▦Class Analysis

4. Select ⚱Collect Answers Files From Class

    NOTE: Before collecting the answers, we recommend that you check the options "Delete Answer File from Device after Collect" and "Delete Assignment File from Device after Collect"

5. Using ▦Class Results Slide Show, discuss the results with your class to check for understanding