Using a Graphing Calculator in the Classroom

When should technology be used?

The graphing calculator is a wonderful tool for teaching concepts.
It also can become a crutch.

GOOD

•Examining the effects of changing slope and y-intercept in linear functions
•Looking at graphical representations of each of the function families.
•A teaching tool for translations, reflections, and dilations in a family of functions
•Looking at the local and global behavior of functions
•Showing the connection between algebraic solution of equations and graphical solutions.
•Data analysis

BAD

•Simple operations of addition, subtraction, multiplication, and division
•Working with fractions

Suggestions

Begin the year with a unit on calculator use. Make sure that all of the students know how to use the various functions needed for your class.

Set a calculator policy for your classroom.

Work on your students' estimation skills.

Have "calculator free" days.

Work on the students "mental math".

Begin each class with a problem set that can be done quickly and without a calculator.

Example problems:

1. $\frac{1}{3}+\frac{1}{2}=$
2. Write as a fraction: $.\overline{3}$
3. Calculate the product: $(x - 4)(2x + 5)$
4. Find 30% of 200
5. Sketch the graph of $\frac{2}{3}x+2$
6. Factor x^2-8x-9
7. Solve $x^2-6x=7$
8. The two legs of a right triangle are 12 and 5. What is the hypotenuse?
9. Expand $(2x-3)^2$
10. Write as a decimal $\frac{1}{6}$

AP Calculus and Graphing Calculator

Students should be able to use the graphing calculator to:

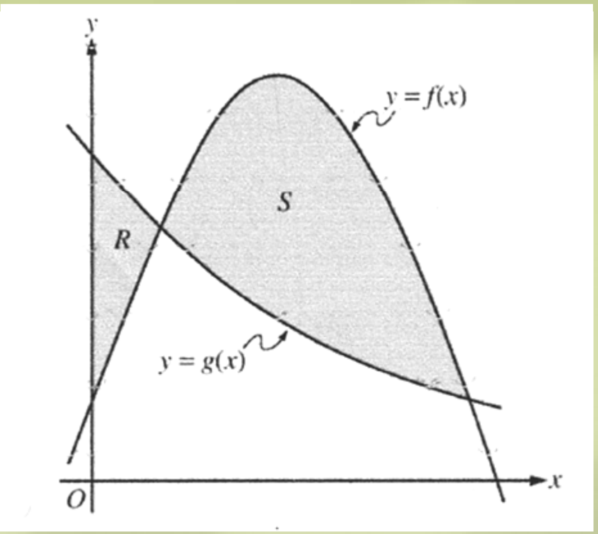
1) Plot the graph of a function within an arbitrary viewing window

2) Find the zeros of functions

3) Numerically calculate the derivative of a function

4) Numerically calculate the value of a definite integral

From the 2005 AP Exam



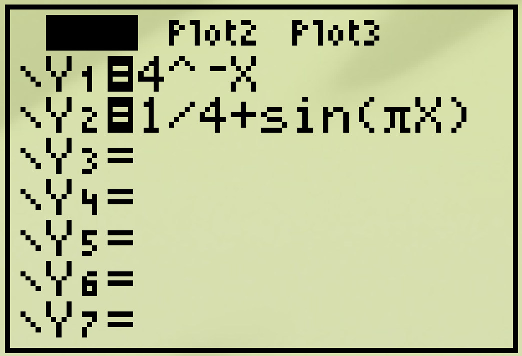
Let f and g be functions given by $f(x)=\frac{1}{4}\sin(\pi x)$ and $g(x)=4^{-x}$.

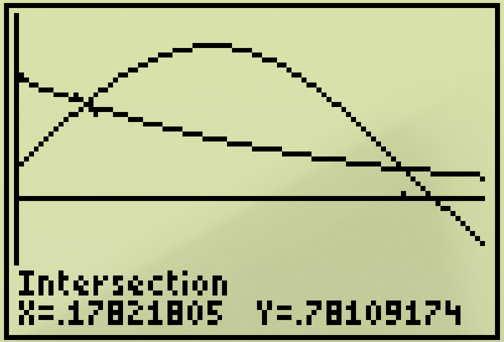
Let R be the shaded region in the first quadrant enclosed by the y-axis and the graphs of f and g, and let S be the shaded region in the first quadrant enclosed by the graphs of f and g as shown in the figure above.

a) Find the area of R.

b) Find the area of S.

Step 1: Find the point of intersection of *R* and *S*.





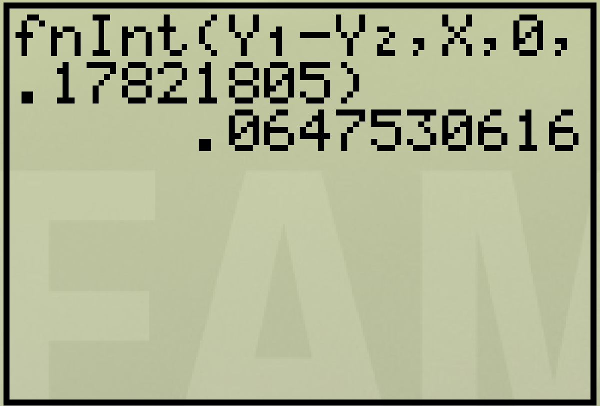
Or – you can find the zero of $4^{-x} - \dfrac{1}{4}\sin(\pi x)$

Step 2: Find the area of region R using definite integration.

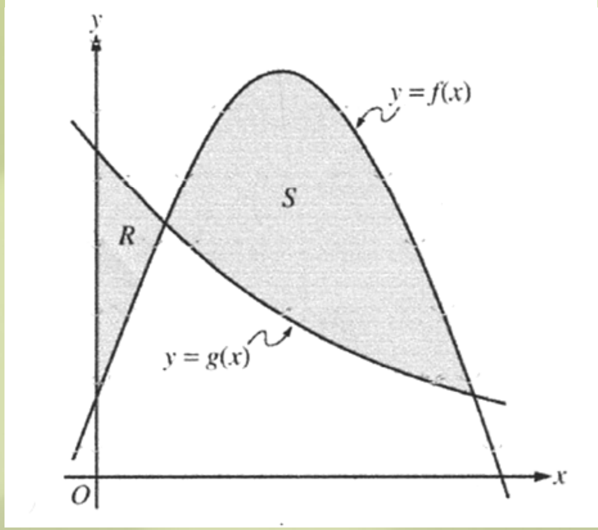
Numerically calculate the value of the definite integral

$$A = \int_0^{.178} 4^{-x} - \left(\frac{1}{4} + \sin(\pi x) \right) dx$$

using the graphing calculator.



Note: Since you have entered the functions f and g in **Y=** in order to draw their graphs, it is easier to use **VARS** in order to enter your expressions. Give the answer to the nearest thousandth.



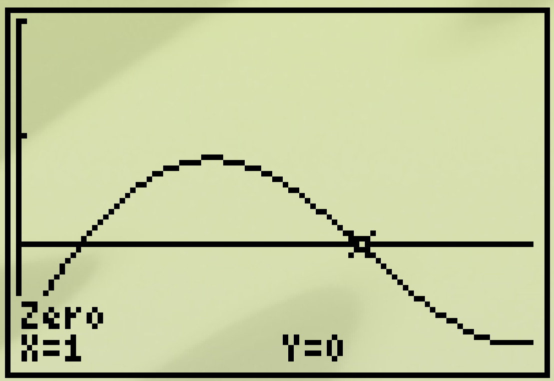
b) Find the area of S.

Find the x-coordinate of the second point of intersection.

Set up the integral.

Use MATH 9:

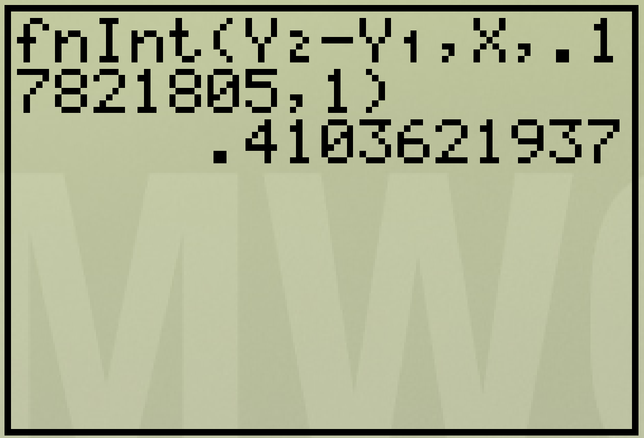
Second point of intersection is at x = 1



Set up the integral

$$A = \int_{.178}^{1} \left(\frac{1}{4} + \sin \pi x - 4^{-x} \right) dx$$

Evaluate MATH 9:



Another use of the definite integral: rate of change to give accumulated change

AP 2004 Question 1

Traffic flow is defined as the rate at which cars pass through an intersection, measured in cars per minute. The traffic flow at a particular intersection is modeled by the function f defined by

$$F(t) = 82 + 4\sin\left(\frac{t}{2}\right) \text{ for } 0 \le t \le 30$$

where F(t) is measured in cars per minute and t is measured in minutes.

a) To the nearest whole number how many cars pass through the intersection over the 30-minute period?

answer: 2474 cars

Finding points of intersection:

1) AP 2003 Question 1

Let R be the region bounded by the graphs of $y = \sqrt{x}$ and $y = e^{-3x}$

Find the point of intersection.

answer: (0.238734, 0.488604)

AP 2003 Question 2

A particle moves along the x-axis so that its velocity at time t is given by

$$v(t) = -(t+1)\sin\left(\frac{t^2}{2}\right)$$

At time t = 0, the particle is at position x = 1

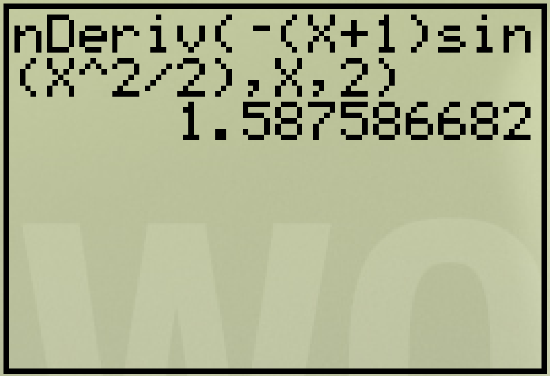
a) Find the acceleration of the particle at time t = 2.

Enter the following key strokes on the graphing calculator:

MATH

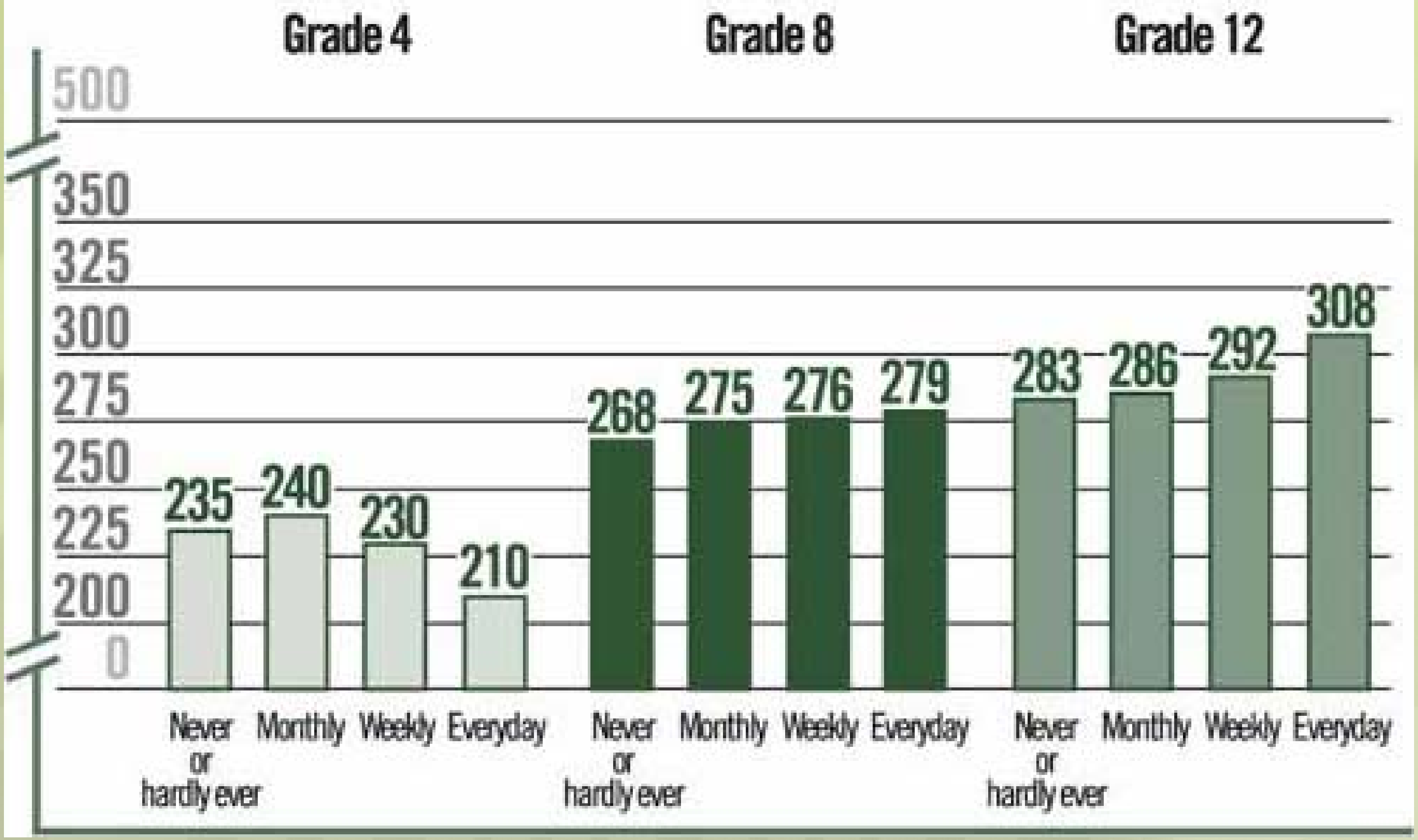
8 :nDeriv(

nDeriv(function, x, value)



answer: a(2) = v’(2) = 1.587 or 1.588

Average Mathematics Scores by Students' Report on Frequency of Calculator Use for Classwork at Grades 4, 8, and 12: 2000



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000 Mathematics Assessment.

Average Mathematics Scores by Students' Report on Type of Current Mathematics Course at Grade 12: 2000