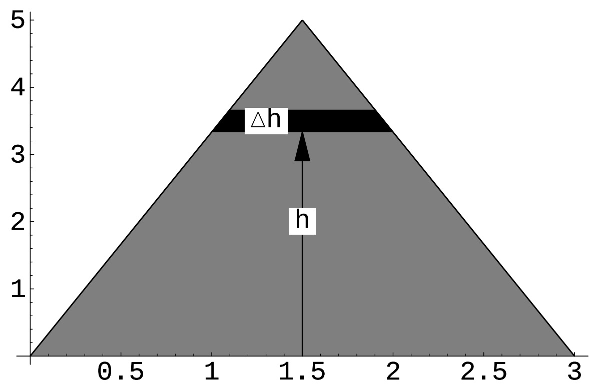
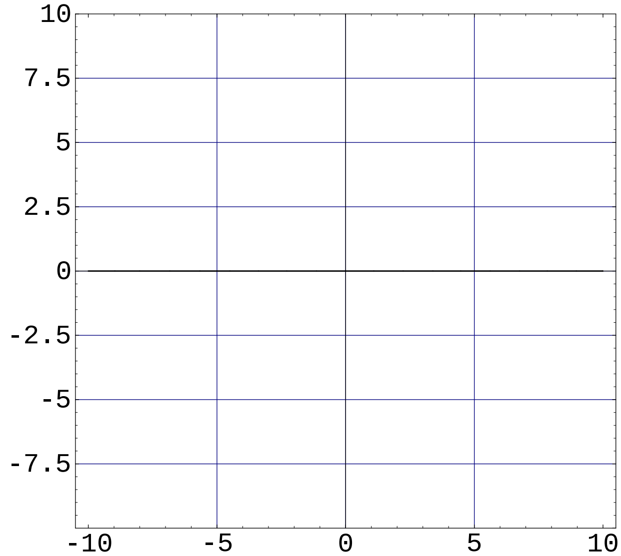
1. Write a Riemann sum and then a definite integral representing the area of the region, using the strip shown. Evaluate the integral exactly. (8.1 section , problem3)



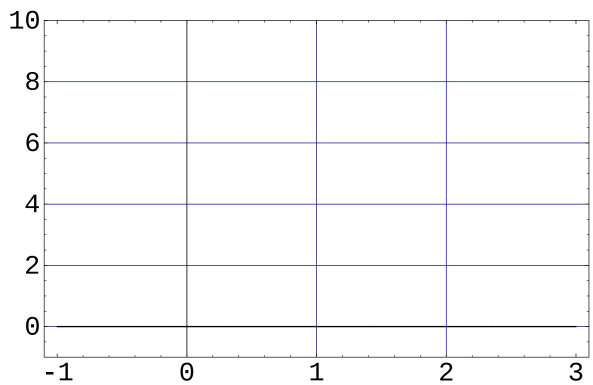
2. A rectangular lake is 100 km long and 60 km wide. The depth of the water at any point of the surface is a tenth of the distance from the nearest shoreline. How much water does the lake contain include units.

3. Show what area the integral represents. Make a sketch to support your answer

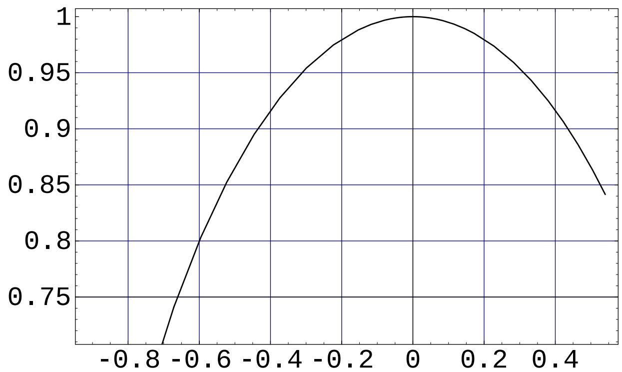
$$\int_{-9}^{9} \sqrt{81 - x^2}\, dx$$



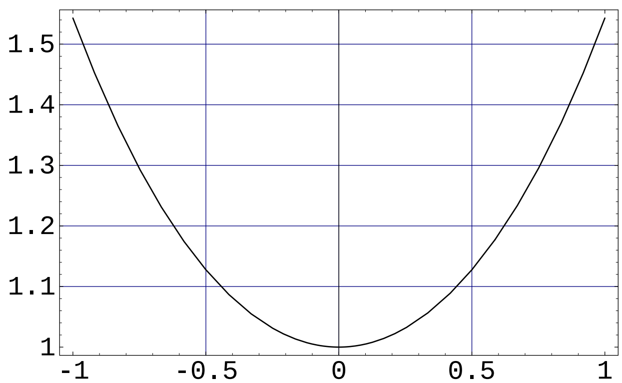
4. The region bounded by y=$(x+1)^2$, y=0, x=1, x=2 is rotated around the x−axis. Sketch the region and find the volume.



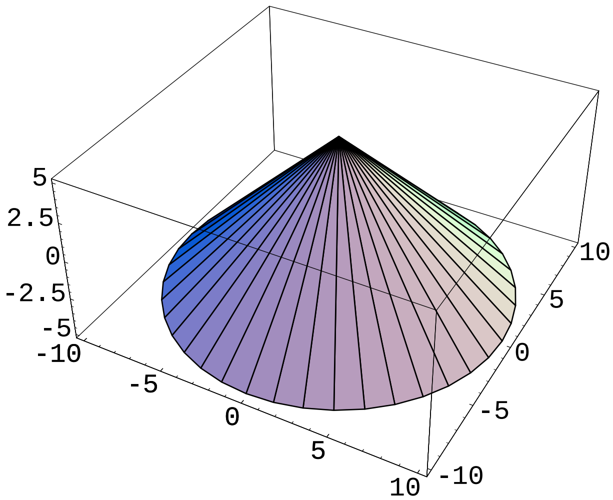
5. Find the length of parametric curve x=cos(e^t), y=sin(e^t) for 0≤t≤ 1.



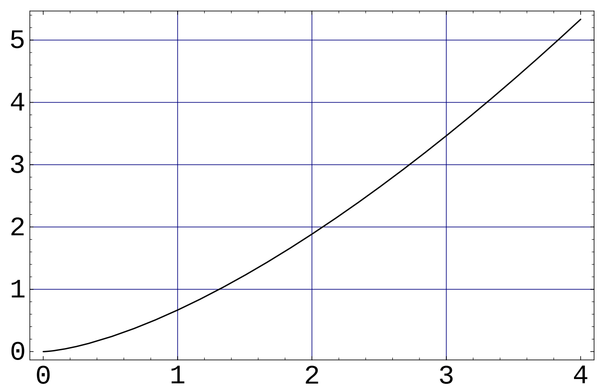
6. The catenary $\cosh(x) = (e^x + e^{-x})/2$ is the shape of a hanging cable. Find the exact length of this catenary between $x = -1$ and $x = 1$.



7. A cone has a circular base (with radius = 10 cm) and height = 5 cm. Use horizontal slices to find the volume of the cone. Remember to include units.

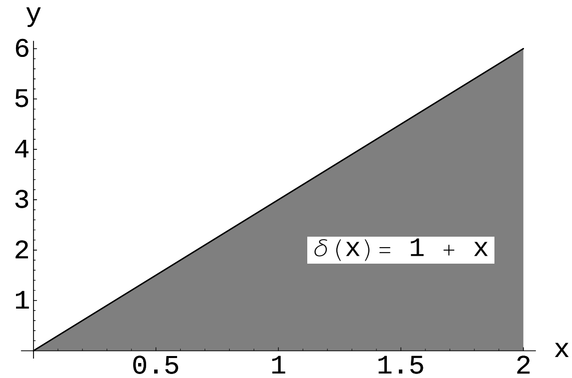


8. Compute the arc length of $f(x) = \frac{2}{3}\, x^{\frac{3}{2}}$ from $x = 0$ to $x = 4$.



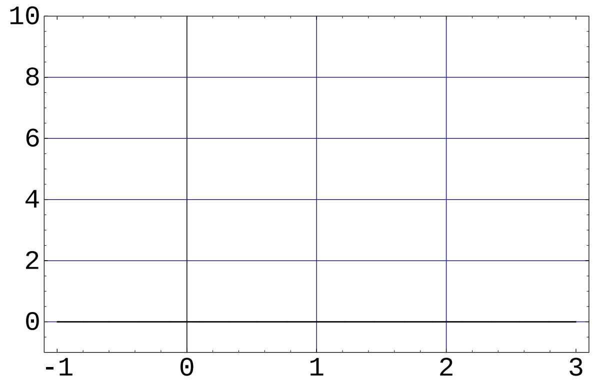
9. Find the total mass of the triangular region in the following figure, which has density

δ(x)=1+x grams/cm^2.



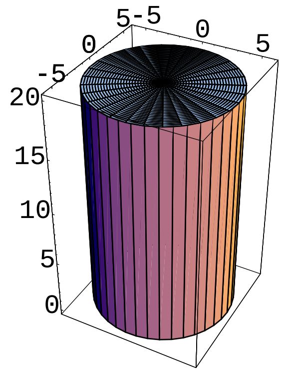
10. A rod of length 3 meters with line density $\delta(\mathrm{x})=1+x^2$ grams/meter lies along the x−axis with its left and at {0, 0}.
A) Compute the total mass of the rod.
B) Compute the center of mass of the rod.

10. A metal plate, with constant density $2\,g/\mathrm{cm}^2$, has a shape bounded by the curve $y = x^2$ and the x−axis, with $0 \leq x \leq 1$ where x and y are measured in cm.
a) Compute the total mass of the plate.
b) Sketch the plate, and mark your guess for $\overline{x}$ (the x−coordinate of the center of mass). Do you think $\overline{x}$ is bigger than or less than 1/2?
c) Compute $\overline{x}$.

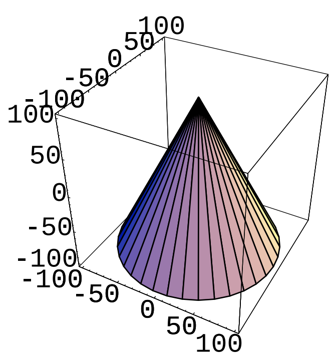


12. How much work is required to lift a1000−kg satellite to an altitude of 2×10^6m about the surface of the earth? The gravitational force is F=GMm/r^2, where M is the mass of the earth, m is the mass of the satellite, and r is the distance between them. The radius of the earth is $6.4\times10^6\ m$, its mass is 6×10^{24} kg, and in these units the gravitational constant, $G = 6.67\times10^{-11}$.

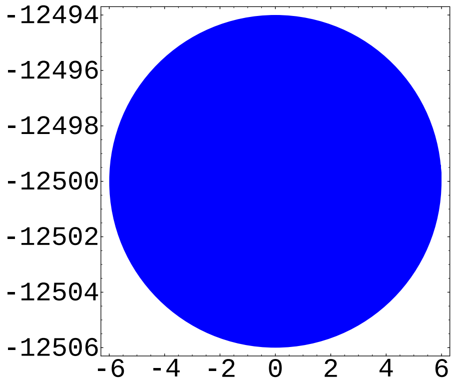
13. A water tank is a right circular cylinder with height 20 ft and radius 6 ft. Find the work required to pump all the water in a full tank up to the top rim.



14. The Great Cone of Haverford College is a monument built by freshmen each year during orientation. It is 100ft. high and its circular base has a diameter of 100ft. It is
built from straw bricks which weigh 2 lbs/ft^3. Use a definite integral to approximate the amount of work required to build the Cone.



15. The ocean liner Titanic lies under 12,500 feet of water at the bottom of the atlantic ocean.
a) What is the water pressure at the Titanic? Give your answer in pounds per square foot and pounds per square inch.
b) Set up and calculate an integral giving the total force on a circular porthole (window) of diameter 6 feet standing vertically with its center at the depth of the Titanic.



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