

Homework 9 - Math 142

Name: _____

Due by 5:00pm Friday, October 23. Send a PDF with your solutions to blins@hsc.edu.

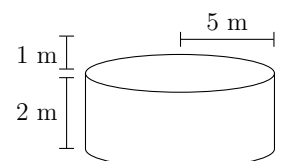
1. Graph the functions $y = x^2$ and $y = 20x - x^2$, find where they intersect, and find the area of the region between the two curves.

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2. Find the average x -value of the region between the two curves in the last problem.

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3. A force of $F = 20x - x^3$ Newtons is needed to stretch a nonlinear spring by x meters. How much work is required to stretch it from $x = 0$ to $x = 2$ meters?

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4. A twenty foot chain that weighs 3 lbs. per foot is hanging from a winch 20 feet above ground level. How much work is needed to wind the chain up?

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5. A cylindrical tank that has a radius of 5 meters and a height of 2 meters is buried so that the top of the tank is 1 meter underground. If the tank is full of water, then how much work is needed to pump all of the water in the tank up to the surface? (Recall that the weight density of water is 9800 Newtons per meter cubed).



6. Write $0.545454\dots$ as a fraction and as a geometric series.

7. For each series below, find the function which equals the sum.

(a) $1 + x^3 + x^6 + x^9 + \dots$

(b) $x^2 + x^5 + x^8 + x^{11} + \dots$

(c) $1 - 2x + 4x^2 - 8x^3 + 16x^4 - \dots$

(d) $1 + \sin x + \sin^2 x + \sin^3 x + \sin^4 x + \dots$

8. Calculate the following sums.

(a) $\frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \frac{1}{81} + \dots$

(b) $1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \frac{1}{16} - \dots$

(c) $5 + 0.5 + 0.05 + 0.005 + 0.0005 - \dots$

(d) $0.1 - 0.01 + 0.001 - 0.0001 + \dots$

9. In class we showed that $-\ln(1-x) = x + \frac{x^2}{2} + \frac{x^3}{3} + \frac{x^4}{4} + \dots$. Find a series for the antiderivative of $-\ln(1-x)$.

10. We also showed that $\arctan(x) = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \dots$. Find a series for the function $\arctan(2x^2)$.
