Mathematics 1120H – Calculus II: Integrals and Series
TRENT UNIVERSITY, Winter 2022

Assignment #7
Optimization With Surface Area and Volume
Due on Friday, 11 March.
(May be submitted on paper or via Blackboard.)*

Please show all your work. As with all the assignments in this course, unless stated otherwise on the assignment, you are permitted to work together and look things up, so long as you acknowledge the sources you used and the people you worked with.

1. Suppose you are given a solid right circular cone with radius r at the blunt end and a height of h. Set up integrals to compute the

   a. total surface area *[3]* and
   b. volume *[3]*

   of the cone, and then compute them using `SageMath`. (You may, if you wish, check your answers by computing the integrals by hand or just by looking up the relevant formulas.)

2. Determine the minimum possible ratio of the surface area to the volume of a right circular cone. *[3]*

3. Dream up a practical application of knowing the answer to **2**. *[1]*

To the tune of *Santa Claus Is Coming To Town*:

> Oh, better take care completing the square;
> You'd better not try dividing by y;
> January exams are coming to town.
> We're making a list, don't shake in your boots;
> Just watch out for extraneous roots.
> January exams are coming to town.
> You know you'll have quadratics
> And exponentials too,
> You rationalize denomi-
> Nators like root two.
> So, you'd better be bright and calculate right,
> You'd better check roots for one that suits;
> January exams are coming to town.

I don't know who wrote these lyrics; a long-ago student named Melanie Goncalves gave me have a copy of this and several other math take-offs on popular Christmas songs.

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* All else failing, please email your solutions to the instructor at: `sbilaniuk@trentu.ca`