

Please present your solutions clearly and in an organized way. Simplify all your final answers. If an answer box is given, write your final answer in the box. If you run out of room, continue on the extra pages provided at the end. **The use of a calculator is not allowed.** Good luck!! 😊

Full Name:

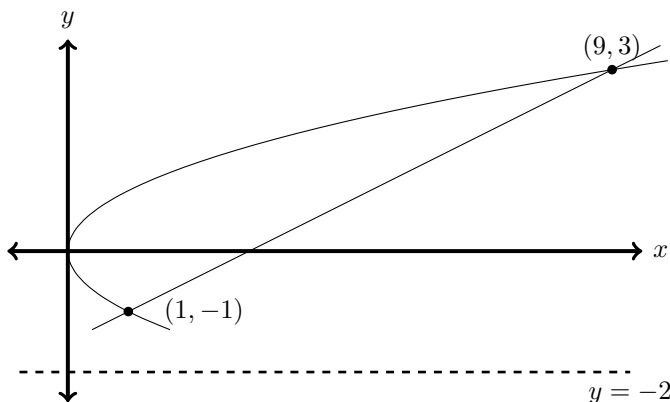
Student ID:

Question	Points	Score
1	20	
2	30	
3	10	
4	20	
5	20	
6	20	
Total:	120	

This exam has 6 questions, for a total of 120 points. The maximum possible score for each problem is given on the right side of the problem.



1.

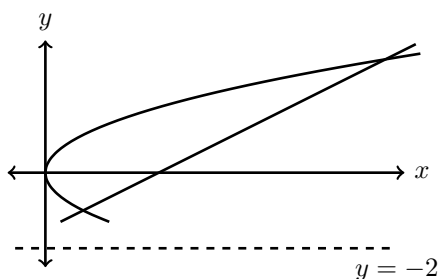


The region bounded by  $x = y^2$  and  $x = 2y + 3$  is revolved about the line  $y = -2$ .

- (a) Give an expression for the volume of this solid using integrals obtained by the **shell method**. You do not have to simplify the integrands or evaluate the integrals. In the diagram provided below, draw a thin rectangle that is used in the calculations.

10

integral expression =

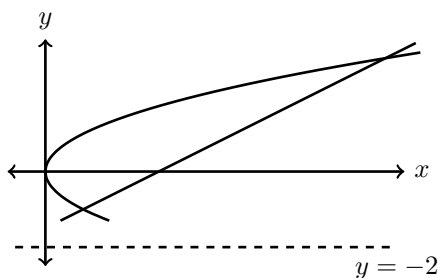




- (b) Give an expression for the volume of this solid using integrals obtained by the **disk/washer method**. You do not have to simplify the integrands or evaluate the integrals. In the diagram provided below, draw a thin rectangle that is used in the calculations.

10

integral expression =





2. Evaluate the following.

(a)  $\frac{d}{dx} \int_0^{x^3} (1+t^2)^4 dt =$

10

(b)  $\int_1^e \frac{(\ln x)^2}{x} dx =$

10



(c)  $\int \frac{6y^2 + 2}{y^3 + y + 4} dy =$

10

3. Without using the fundamental theorem of calculus, show that  $\int_{200}^{500} \frac{dx}{x} = \int_2^5 \frac{dx}{x}$ .

10



4. Let  $f(x) = 4 - x - x^{25}$ .

(a) Show that  $f$  is one-to-one.

10

(b) Evaluate:  $(f^{-1})'(2) =$

10



10

5. (a) Find the average value of  $f(x) = 3x^2$  on the interval  $[-1, 2]$ .

average value =

- (b) Find the average value of  $f(x) = \frac{x^7}{1+x^2}$  on the interval  $[-2, 2]$ .

average value =

10



6. Sketch the graph of a function  $f$  that is continuous on  $[0, 1]$  and meets the given conditions. If this is not possible, give a reason why.

(a)  $\int_0^1 f(x) dx = 0$       and       $\int_0^1 |f(x)| dx \neq 0.$

10

(b)  $\int_0^1 f(x) dx \neq 0$       and       $\int_0^1 |f(x)| dx = 0.$

10





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Name a Pokémon: