

Calculus II
Midterm 1 Fall 2018

Name: _____ **ID:** _____

Instructions:

- (1) Fill in your name and Columbia University ID at the top of this cover sheet.
- (2) This exam is closed-book and closed-notes; no calculators, no phones.
- (3) Leave your answers in exact form (e.g. $\sqrt{2}$, not ≈ 1.4) and simplify them as much as possible (e.g. $1/2$, not $2/4$) to receive full credit.
- (4) Answer all questions in the space provided. If you need more room use the blank backs of the pages.
- (5) Show your work; correct answers alone will receive only partial credit.
- (6) This exam has 5 extra credit points.

Problem	1 (10 pts)	2 (10 pts)	3 (10 pts)	4 (10 pts)	5 (10 pts)	6 (10 pts)	7 (15 pts)	8 (25 pts)	Total (100 pts)
Score									

Evaluate the following integrals. Each part worths 10 points:

1. $\int_0^1 \frac{\arctan^2(x) + 1}{x^2 + 1} dx$

2. $\int e^{3t} \cos(2t) dt$

3. $\int_1^3 \frac{3x+1}{x^2-2x-15} dx$

4. $\int \sin^2(x) \cos^4(x) dx$

5. $\int \frac{\cos(x) \sin(x)}{2 - \cos(x)} dx$

6. $\int_0^2 t^3 e^{t^2} dt$

7. (15 points) Albert's boomerang has the shape of the region enclosed by the parabolas $y = x^2 - 3x + 3$ and $y = 2x^2 - 6x + 5$. Find the area of his boomerang.

8. (25 points) Let \mathcal{R} be the region enclosed by the x -axis, y -axis, $x = \frac{\pi}{3}$, and the curve $y = \cos(x)$.

(a) Sketch the shape of this region in the coordinate plane.

(b) Let \mathcal{S} be the solid given by rotating the region \mathcal{R} about the y -axis. Find the volume of \mathcal{S} .

(c) Let \mathcal{T} be the solid given by rotating the region \mathcal{R} about the horizontal line $y = 2$. Find the volume of \mathcal{T} .