Name: _____

PID: _____

TA: _____

Math 10B: Practice Midterm 2

Print your name at the top of every page and write your PID in the space provided above.
Turn off and put away your cell phone.
No calculators or any other electronic devices are allowed during this exam.
You may use one page of notes, but no books or other assistance during this exam.
Read each question carefully, and answer each question completely.
Show all of your work; no credit will be given for unsupported answers.
Write your solutions clearly and legibly; no credit will be given for illegible solutions.
If any question is not clear, ask for clarification.
You have 50 minutes.

1. Evaluate each integral.

   (a) $\int \sin^2(3t)\,dt$

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(b) $\int \tan^3 x \sec^3 x \, dx$

(c) $\int \dfrac{4x^2 + 3}{x^3 + x} \, dx$

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(d) $\int x^2 \sin(2x)\, dx$

(e) $\int \frac{1}{\left(\sqrt{16-x^2}\right)^3}\, dx$

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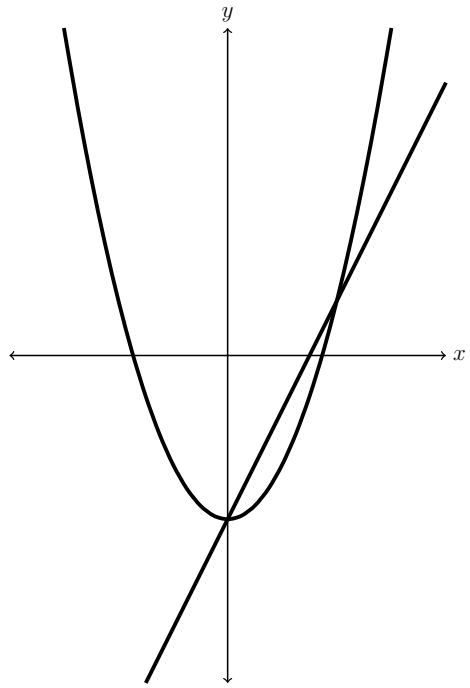
2. Below are the graphs of $y = x^2 - 3$ and $y = 2x - 3$.



Set up, **but do not evaluate**, an integral for each of the following:

(a) The area of the region enclosed by the graphs of $y = x^2 - 3$ and $y = 2x - 3$.

(b) The volume of the solid obtained by rotating the region enclosed by the graphs of $y = x^2 - 3$ and $y = 2x - 3$ about the line $y = 2$.

(c) The volume of the solid whose base is the region enclosed by the graphs of $y = x^2 - 3$ and $y = 2x - 3$ and whose cross-sections perpendicular to the y-axis are squares.

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3. Determine whether the improper integral is convergent or divergent. Justify your answer.

(a) $\displaystyle\int_1^e \frac{1}{x\sqrt{\ln x}}\,dx$

(b) $\displaystyle\int_1^\infty \frac{3\sqrt{x}}{1+x^2}\,dx$ *Hint: Use the comparison theorem.*

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4. A population is modeled by the differential equation $\frac{dP}{dt} = 2P\left(1 - \frac{P}{300}\right)$.

   (a) Verify that $P = \frac{300e^{2t}}{1 + e^{2t}}$ is a solution of the differential equation.

   (b) Find the equilibrium solutions of the differential equation.