

Instructions: Please self-score your work out of 35 using the answers and point values below. We recommend that

- Students who score a total above 24 use their Calculus I credit;
- Students who scored a total of 10-24 enroll in Math 111L Calculus I to strengthen their understanding of Calculus I material;
- Students who scored a total below 10 take the Precalculus Self-Assessment at <https://math.duke.edu/courses/self-assessments> and consider enrolling in Math 105L Calculus I to strengthen their understanding of both Precalculus and Calculus I material.

To discuss placement further, we encourage you to reach out the Math 111L Calculus I coordinator, Prof. Shira Viel, at [shira.viel@duke.edu](mailto:shira.viel@duke.edu).

1. (a) 2, (b)  $\frac{4}{9}$ , (c) 0, (d)  $\frac{1}{8}$ , (e)  $\frac{\pi}{4}$ 
  - 5 points: 1 point per part
  - Topic: Evaluating limits, including L'Hopital's Rule and Riemann Sums
2.  $a = e, b = 2$ .
  - 2 points: 1 point per constant
  - Topics: Continuity and Differentiability
3. (a)  $y = -5$ , (b)  $x = -1, x = 1$ , (c) none, (d) local minimum at  $x = 0$ 
  - 5 points: 1 point per (a),(b),(c), 2 points for (d)- 1 for crit pt, 1 for classification.
  - Topics: Rational functions, Critical points
4. (a.i)  $\frac{3}{2}$ , (a.ii)  $\frac{11}{2\sqrt{2}}$ , (a.iii)  $\frac{11}{16}$ , (a.iv)  $\frac{1}{4}$ ,  
 (b.i) 3, (b.ii)  $8\ln(2)$ , (c) 2.3, (d) Overestimate.
  - 8 points: 1 point per part
  - Topics: Definition of the derivative, Rules for differentiation, Linear approximation
5. (a)  $\frac{4y - 8x}{8y - 4x}$ , (b)  $\left(1, \frac{1}{2}\right)$  and  $\left(-1, -\frac{1}{2}\right)$ 
  - 3 points: 1 point part (a), 2 points part (b)
  - Topic: Implicit Differentiation and Linear Approximation
6.  $h = \frac{400}{\pi}$  meters and  $w = 0$  meters. Global max by either 1st or 2nd Derivative Test.
  - 3 points: 1 point per dimension, 1 point for justification
  - Topic: Optimization

7. 0.5 m/sec

- 2 points
- Topic: Related Rates

8. (a)  $54 \cos(18)$ , (b)  $\frac{11}{3}$ , (c)  $\frac{1}{2}e^2 - \frac{13}{6}$

- 3 points: 1 point per part
- Topic: Fundamental Theorem of Calculus

9. (a)  $\frac{dF}{dt} = 60 - kF, F(0) = 0$ , (b) 0.2, (c)  $F(t) = -300e^{-0.2t} + 300$ .

- 4 points: 1 point per parts (a),(b), 2 points for (c)- general solution + coefficient
- Topic: Separable Differential Equations and Modeling