

## Math 170 Calculus I

Exam IV Review ◦ Exam IV: Wednesday, December 5, 2018

Exam IV will be based on material from Sections 4.8, 5.2, 5.3, 5.6, 5.9. There will not be questions specifically from 5.1 or 5.5, though techniques in those sections may be useful to know.

### You will be expected to know:

- the required conditions to apply Rolle's and Mean Value Theorems
- how to find the values predicted by Rolle's and Mean Value Theorems
- how to find the indefinite integral of an expression directly
- how to check that an integral is correct
- how to solve an initial value problem to find a specific antiderivative
- how to find the indefinite integral of an expression using substitution
- how to evaluate a definite integral using the Fundamental Theorem of Calculus
- how to apply the Fundamental Theorem of Calculus Part II to find the derivative of a function defined as a definite integral
- how to evaluate a definite integral using the Fundamental Theorem of Calculus and substitution

### Some sample problems:

1. Let  $f(x) = \frac{1}{2}x - \sqrt{x}$ . Verify that the hypotheses of Rolle's Theorem are satisfied on the interval  $[0, 4]$ , and find any values of  $c$  predicted by the theorem.
2. Let  $f(x) = x^3 + x - 4$ . Verify that the hypotheses of the Mean Value Theorem are satisfied on the interval  $[-1, 2]$ , and find any values of  $c$  predicted by the theorem.
3. Find the solution  $y(x)$  of the initial value problems:
  - (a)  $y' = 3x^2 - 4$ ,  $y(0) = 2$
  - (b)  $y' = 4x^3 - 9 + 2\sin(x) + 7e^x$ ,  $y(0) = 15$

### 4. Find the integrals

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|--|---|
| (a) $\int 4x^2 - 5x^3 + 1 \, dx$                 | (h) $\int \frac{5 - 3\sin^2(x)}{\sin^2(x)} \, dx$ |
| (b) $\int \sin(x) - \cos(x) \, dx$               | (i) $\int \frac{4}{x^2} \, dx$                    |
| (c) $\int x^4 + x^{-4} \, dx$                    | (j) $\int \frac{dx}{1 + x^2}$                     |
| (d) $\int \frac{4x^8 - 2x^4 + 13x^2}{x^3} \, dx$ | (k) $\int \tan(2\theta) \, d\theta$               |
| (e) $\int dx$ (this is not a typo!)              | (l) $\int x(1 + x^3) \, dx$                       |
| (f) $\int (x + \sqrt[3]{x})(2 - x^2) \, dx$      | (m) $\int (4x^3 - 6x + 8) \, dx$                  |
| (g) $4 \int \sec^2(x) \, dx$                     | (n) $\int e^x(e^x - 2)^3 \, dx$                   |

5. Let  $F(x) = \int_1^x \frac{\sin(t^2 - 4)}{\sqrt{1 + 5t^4}} \, dt$ . Use the Fundamental Theorem of Calculus to find  $F'(x)$ .

### 6. Find the integrals

- |   |  |
|---|--|
| (a) $\int_{-1}^3 (3x^2 - 2x + 1) \, dx$     | (g) $\int_{-1}^1 (3x - 1)\sqrt{3x^2 - 2x + 3} \, dx$ |
| (b) $\int_4^5 \frac{2}{\sqrt{x}} - x \, dx$ | (h) $\int_0^{\pi/2} \sin^5(x) \cos(x) \, dx$         |
| (c) $\int_{-1}^2 2x(1 - x^2) \, dx$         | (i) $\int_2^5 x^2\sqrt{x^3 - 4} \, dx$               |
| (d) $\int_0^5  3x - 9  \, dx$               | (j) $\int_0^1 \frac{x}{3x^2 + 1} \, dx$              |
| (e) $\int_1^2 \frac{x}{3x^2 - 2} \, dx$     | (k) $\int_0^8 \frac{x}{(x + 1)^{3/2}} \, dx$         |
| (f) $\int_{1/2}^1 \frac{1}{2x} \, dx$       |  |