

Record your answers to the multiple choice problems by placing an \times through one letter for each problem on this page. There are 12 multiple choice questions worth 7 points each. You start with 16 points.

You may not use a calculator.

1. a b c d e2. a b c d e3. a b c d e4. a b c d e5. a b c d e6. a b c d e7. a b c d e8. a b c d e9. a b c d e10. a b c d e11. a b c d e12. a b c d e

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1. a b c d e

7. a b c d e

2. a b c d e

8. a b c d e

3. a b c d e

9. a b c d e

4. a b c d e

10. a b c d e

5. a b c d e

11. a b c d e

6. a b c d e

12. a b c d e

1. Evaluate $\int_0^{\pi/8} \cos^2(x) \sin^2(x) dx$

- (a) $(\pi - 2)/64$ (b) $(\pi - 1)/64$ (c) $(\pi + 1)/64$ (d) $(\pi + 4)/64$ (e) $(\pi + 2)/64$

2. Evaluate $\int_0^{1/\sqrt{2}} \frac{\sin^{-1}(x)}{\sqrt{1-x^2}} dx$.

- (a) $1 - \pi^2/16$ (b) $-\ln(\sqrt{2})$ (c) $\pi^2/32$ (d) $\pi/4$ (e) $\frac{1}{4}$

3. Use integration by parts to evaluate $\int x^2 e^{x/3} dx$.

- (a) $(x^2 - 9x + 2)e^{x/3} + C$ (b) $(2x^2 - 6x + 24)e^{x/3} + C$
(c) $(x^2 - 3x + 36)e^{x/3} + C$ (d) $(3x^2 - 4x + 12)e^{x/3} + C$
(e) $(3x^2 - 18x + 54)e^{x/3} + C$

4. Compute the limit $\lim_{x \rightarrow \infty} \left(1 + \frac{2}{x-1}\right)^{3x}$.

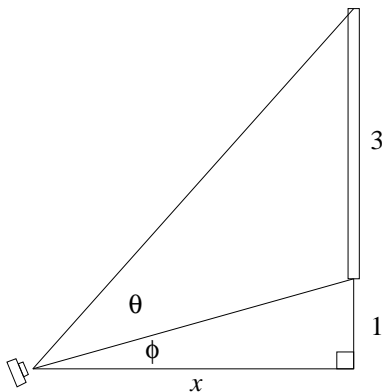
- (a) e (b) e^3 (c) 1 (d) e^6 (e) e^2

5. Use a trigonometric substitution to evaluate $\int_1^2 \frac{1}{x^2 \sqrt{4x^2 - 1}} dx$.

- (a) $\frac{1}{\sqrt{15}} - \frac{1}{\sqrt{3}}$ (b) $\sqrt{5} - \sqrt{3}$ (c) $\frac{2}{\sqrt{5}} - \frac{4}{\sqrt{3}}$ (d) $3\sqrt{5} - \frac{\sqrt{3}}{2}$ (e) $\frac{\sqrt{15}}{2} - \sqrt{3}$

6. A photographer is taking a picture of a three-foot tall painting hung on a wall in an art gallery. The camera is one foot below the lower edge of the painting, as shown in the figure below. Determine the distance x the camera should be from the wall to maximize the angle θ subtended by the camera lens.

Hint: Let ϕ be the angle to the bottom of the picture as shown in the figure. Find the tangent of $\theta + \phi$ and the tangent of ϕ , then use inverse functions to solve for θ as a function of x .



- (a) 5 (b) 2 (c) 4 (d) 1 (e) 3

7. Let $f(x) = \frac{1 - e^{2x}}{1 + e^{2x}}$. Find $f^{-1}(x)$.

- (a) $2 \ln \left[\frac{1+x}{1-x} \right]$ (b) $2 \ln[1 - x^2]$ (c) $\frac{1}{2} \ln \left[\frac{1-x}{1+x} \right]$
 (d) $\frac{1}{2} \ln \left[\frac{1+2x}{1-2x} \right]$ (e) $\ln \left[\frac{1-2x}{1+2x} \right]$

8. Let $f(x) = x^3 + 2x - 1$. Find $(f^{-1})'(2)$.

- (a) 1/7 (b) 1/14 (c) 1/5 (d) 1/3 (e) 1/2

9. Find the derivative of x^{a^x} where a is a positive constant.

- (a) $x^{a^x} a^x \ln(a)$ (b) $x^{a^x} a^x \left(\ln(ax) + \frac{1}{x} \right)$ (c) $a^x \left(\ln(x) \ln(a) + \frac{1}{x} \right)$
- (d) $a^x x^{a^x-1}$ (e) $x^{a^x} a^x \left(\ln(a) \ln(x) + \frac{1}{x} \right)$

10. Solve for x in the equation $2^x = 3^{1-x}$.

- (a) $\sqrt{2/3}$ (b) $\sqrt{3/2}$ (c) $\ln(3)/\ln(6)$.
- (d) $\ln(3)/\ln(2)$. (e) $\ln(2)/\ln(3)$.

11. Use L'Hospital's Rule to evaluate $\lim_{x \rightarrow \pi} \frac{\sin(x)}{\ln(\pi/x)}$.

- (a) ∞ (b) 1 (c) π (d) 0 (e) π^2

12. Evaluate $\int \frac{6}{9-x^2} dx$.

- (a) $-3 \ln(9-x^2) + C$ (b) $2 \tanh^{-1} \left(\frac{x}{3} \right) + C$ (c) $6 \sin^{-1}(x) + C$
- (d) $\frac{2}{3} \tan^{-1}(x) + C$ (e) $\frac{2}{3} \sinh^{-1} \left(\frac{x}{3} \right) + C$