

Challenging Calculus Students with True False Questions—AMATYC 2017, S124

Stephanie Garofalo, Georgia State University Perimeter College

Calculus I True/False Questions:

Circle True or False. Provide an explanation or counterexample for **each** answer.

- If $\lim_{x \rightarrow 3} f(x)$ exists, then $\lim_{x \rightarrow 3} f(x) = f(3)$.
- If p is a polynomial, then $\lim_{x \rightarrow b} p(x) = p(b)$.
- If f is continuous at $x = a$, then f is differentiable at $x = a$.
- If $h(x)$ is differentiable, then $\frac{d}{dx} \sqrt{h(x)} = \frac{h'(x)}{2\sqrt{h(x)}}$.
- If $g(x) = e^{2x}$, then $g'(x) = 2xe^{2x-1}$.
- L'Hospital's Rule can be used to evaluate $\lim_{x \rightarrow 0} \frac{x \sin(x \cos x)}{e^{x^2} 2^{\tan x} - 1}$.
- If $h(x) = \frac{f(x)}{g(x)}$ then $h'(x) = \frac{f'(x)}{g'(x)}$.
- If $f'(c) = 0$ then f must have a local maximum or minimum at $x = c$.
- A function must have a local maximum or minimum at each of its critical numbers.
- If f is concave down then f' is decreasing.
- If f' is positive then the slopes of the tangent lines are increasing.
- If $f(x)$ has a local maximum at $x = a$ then $f(a)$ must be the largest value of the function.
- $\int \frac{f(x)}{g(x)} dx = \frac{\int f(x) dx}{\int g(x) dx}$

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Calculus II True/False Questions:

Circle True or False. Provide an explanation or counterexample for **each** answer.

- If f is continuous on $[a, b]$ and $f(x) \geq 0$ then $\int_a^b \sqrt{f(x)} dx = \sqrt{\int_a^b f(x) dx}$.
- If $\int_0^1 f(x) dx = 0$ then there is no area under the function on $[0, 1]$.
- $\int_0^4 \frac{x}{x^2 - 1} dx = \frac{1}{2} \ln 15$
- In order to integrate $\int \frac{x^3}{4} \left(\frac{1}{x} \right) dx$ integration by parts should be used.
- In order to integrate $\int \frac{1}{x\sqrt{1-x^2}} dx$ u-substitution should be used.
- If f is continuous on $[a, b]$ then there exists a number c in $[a, b]$ such that $f(c) = \frac{1}{b-a} \int_a^b f(x) dx$.
- The partial fraction decomposition for $\frac{x+1}{x^2(x^2+2)}$ is $\frac{A}{x^2} + \frac{Bx+C}{x^2+2}$.

Additional Questions

- Which of the expressions below are equivalent to $\int_a^b f(x) dx$, $0 < a < b$? (Circle the *answer or answers*)

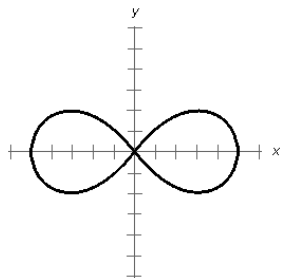
a. $\int_b^a f(x) dx$ b. $-\int_b^a f(x) dx$ c. $\int_a^d f(x) dx + \int_d^b f(x) dx$ d. $\int_0^a f(x) dx + \int_0^b f(x) dx$

- Is the series below a power series? Why or why not?

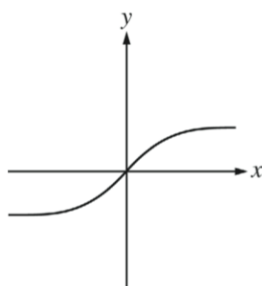
$$\sum_{n=1}^{\infty} \frac{(-1)^n}{n!} n^4$$

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- Without graphing it on the calculator, is the graph below the graph of $r^2 = 5 \sin(2\theta)$? Give a reason for your answer.



- The function graphed below could be the solution to which differential equation? Provide an explanation for your choice. A. $y' = -2x^2 - y^2$ B. $y' = \frac{1}{1 + e^{x^2 + y^2}}$



- Which of the choices below is equal to $\csc^2 \theta$: (Circle the correct answer or answers)

a. $1 - \cot^2 \theta$ b. $1 - \tan^2 \theta$ c. $1 + \cot^2 \theta$ d. $1 + \tan^2 \theta$

- Which of the following is equal to $\sin(-2x)$: (Circle the correct answer or answers)

b. $-2 \sin x \cos x$ b. $2 \sin x$ c. $\frac{-1}{\csc(2x)}$ d. $2 \sin x \cos x$

- Which of the following is equal to $\cos^2 \theta$: (Circle the correct answer or answers)

c. $1 + \sin^2 \theta$ b. $\cos^2(-\theta)$ c. $\sin^2 \theta - 1$ d. $1 - \sin^2 \theta$

- Which of the following is equal to $\cos(4x)$: (Circle the correct answer or answers)

d. $\cos^2(2x) - \sin^2(2x)$ b. $4 \cos x$ c. $\cos(-4x)$ d. $1 - 4 \sin^2 x$