Linear Approximation
Math 102 Section 107

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Calculate the Derivative!

Q1. $h(x) = \frac{1}{\sqrt{x^2+2}}$. Then $h'(x) =$

A. $h'(x) = \frac{-1}{2(x^2+2)^{3/2}}$

B. $h'(x) = \frac{-x}{(x^2+2)^{3/2}}$

C. $h'(x) = \frac{-1}{2(x^2+2)}$

D. Don't know, explain

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Answer: B. $\frac{1}{\sqrt{x^2+2}} = (x^2+2)^{-1/2}$. Use the Chain rule: $h(x) = f(g(x))$ with $g(x) = x^2 + 2$ and $f(x) = x^{-1/2}$.

Linear Approximation of $\sqrt[3]{995}$

Q2. What **function** $f(x)$ should we be using linear approximation on to approximate $\sqrt[3]{995}$?

A. $f(x) = x^3$

B. $f(x) = \sqrt[3]{x}$

C. $f(x) = x^3 - 5$

D. Other

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D. Other

Answer: B, $f(x) = \sqrt[3]{x}$.

Linear Approximation of $\sqrt[3]{995}$

Q3. We will draw the tangent line at $x = a$. What is a good value of a at which to do this?

A. $a = 10$

B. $a = 995$

C. $a = \sqrt[3]{995}$

D. Other

Linear Approximation of $\sqrt[3]{995}$

Q3. We will draw the tangent line at $x = a$. What is a good value of a at which to do this?

A. $a = 10$ B. $a = 995$

C. $a = \sqrt[3]{995}$ D. Other

Answer: D, $a = 1000$. B doesn't work because in order to calculate there, we'd need to know $\sqrt[3]{995}$ already! A and C are thinking about the value of $f(x)$, not x, so they don't make sense.

Linear Approximation of $\sqrt[3]{995}$

Q4. Is the linear approximation larger than $\sqrt[3]{995}$, or smaller?

A. $\text{Approximation} > \sqrt[3]{995}$

B. $\text{Approximation} < \sqrt[3]{995}$

Linear Approximation of $\sqrt[3]{995}$

Q4. Is the linear approximation larger than $\sqrt[3]{995}$, or smaller?

A. $\text{Approximation} > \sqrt[3]{995}$

B. $\text{Approximation} < \sqrt[3]{995}$

Answer: B. It is an underestimate because the function $\sqrt[3]{x}$ is **concave down** at $x = 1000$.