

Practice test 2

The actual exam will consist of 6 multiple choice questions and 6 regular problems.
You will have 1 hour to complete the exam.

Multiple choice questions: circle the correct answer

- Find the derivative of $\sqrt{2x}$.
A. $\frac{2}{\sqrt{x}}$ B. $\frac{2}{\sqrt{2x}}$ C. $\frac{1}{2\sqrt{x}}$ D. $\frac{1}{\sqrt{2x}}$ E. $\frac{1}{2\sqrt{2x}}$
- Find the fifth derivative of $\cos(x)$.
A. $\sin(x)$ B. $-\sin(x)$ C. $\cos(x)$ D. $-\cos(x)$ E. 0
- Evaluate $\lim_{x \rightarrow -\infty} e^x$.
A. $-\infty$ B. 0 C. 1 D. $+\infty$ E. does not exist
- Find the horizontal asymptote of $f(x) = \frac{x+2}{x-5}$.
A. $x = -2$ B. $y = -2$ C. $y = 1$ D. $x = 5$ E. $y = 5$
- Find the vertical asymptote of $f(x) = \frac{x+2}{x-5}$.
A. $x = -2$ B. $y = -2$ C. $y = 1$ D. $x = 5$ E. $y = 5$

Regular problems: show all your work

- Differentiate the following functions:
 - $f(x) = 3 \cos(x^5) + \frac{\pi}{2}$
 - $f(x) = \cos(4)(x^3 - 3x)$
 - $g(x) = \frac{x^3 - 5}{\cos(-x)}$
 - $h(x) = \tan(x) \left(\frac{1}{\sqrt[4]{x^3}} + \frac{2}{x} \right)$
- Find the first five derivatives of $g(x) = 27x^{4/3}$
- Find the points where the tangent line to the graph of $f(x) = x^5 - 80x$ is horizontal.
- Find an equation of the tangent line to $y = \sqrt{2x+3}$ at $(3, 3)$.
- Find the linearization of $g(x) = \sqrt{x}$ at $x = 1$ and use it to approximate $\sqrt{1.14}$.

11. Consider the curve given by $x^3y^3 - 3xy^3 + 4y = 6$.
- Use implicit differentiation to find $y'(x)$.
 - Check that the point $(2, 1)$ lies on this curve.
 - What is the slope of the tangent line to this curve at $(2, 1)$?
12. A boy starts walking west at 6 km/h from a point P . Five minutes later a girl starts walking (a) north (b) east at 4 km/h from a point 15 km due south from P . At what rate is the distance between the kids changing 45 km after the girl starts walking? Is the distance increasing or decreasing at this instant?
13. A snowball is melting so that its radius is decreasing at a rate of 1 cm/min. Find the rate at which its volume is decreasing when the radius is 3 cm.
14. Find the critical numbers and local maxima and minima of $f(x) = x^3 - 3x^2 + 5$.
15. Find the absolute maximum and minimum values of $f(x) = \sin x$ on the interval $\left[0, \frac{5\pi}{4}\right]$.
16. Evaluate the limits:
- $\lim_{x \rightarrow \infty} \frac{2x^3 + x - 5}{5x^3 - x^2}$
 - $\lim_{x \rightarrow -\infty} \frac{x + 1}{x^2 + 1}$
 - $\lim_{x \rightarrow \infty} \sqrt{x^2 + 3x - 2} - x$
 - $\lim_{x \rightarrow \infty} \tan x$
17. Let $f(x) = \frac{x}{(1+x)^2}$. Find the following:
- domain
 - intercepts
 - vertical and horizontal asymptotes
 - critical numbers
 - intervals of increase and decrease
 - local and absolute maxima and minima
 - intervals of concavity
 - inflection points
 - sketch the graph of $f(x)$