

Do not use l'Hôpital's rule on this test. (If you don't know what that is, don't worry.)

1. (10 pts.)
 - (a) Suppose that f is defined in an open interval containing a , except possibly at a itself. State the formal δ, ε definition of $\lim_{x \rightarrow a} f(x) = L$.
 - (b) Use the formal definition to prove that $\lim_{x \rightarrow 2} 2x^2 - 8x = -8$.
2. (15 pts.) Evaluate these limits, showing your work:
 - (a) $\lim_{x \rightarrow \infty} \frac{x+1}{\sqrt{2x^2+3x}}$.
 - (b) $\lim_{x \rightarrow 3} \frac{\sqrt{x+1}-2}{x-3}$.
 - (c) $\lim_{x \rightarrow \frac{1}{2}^-} \frac{|2x-1|}{2x^2+x-1}$.
3. (5 pts.) For what number x is does the component of $\langle 1, x \rangle$ along the vector $\langle 3, 4 \rangle$ equal 2?
4. (10 pts.) What is the domain of $g(x) = \sqrt{4-9x^2}$? What is the range of g ? Explain your answers.
5. (10 pts.) If $\vec{r}(t) = \langle t^2 + 2t, 3t \rangle$, determine $\lim_{h \rightarrow 0} \frac{1}{h} (\vec{r}(1+h) - \vec{r}(1))$.
6. (10 pts.) Solve the inequality $\frac{x}{x+1} > 2$. (Your answer will be an interval or union of intervals.)
7. (10 pts.) An object is moving in the xy -plane, and its position after t seconds is $\vec{r}(t) = (t+2)\vec{i} + (6t-t^2)\vec{j}$.
 - (a) Does the object go through the point $(4, 2)$? Why or why not?
 - (b) Find an equation in x and y whose graph is the path of the object.
8. (10 pts.) Suppose that $\sin \theta = \frac{1}{3}$, and that $\frac{\pi}{2} < \theta < \pi$. Find $\cos \theta$ and $\tan \theta$.
9. (10 pts.) A function f is defined by

$$f(x) = \begin{cases} 2x - 3, & x < 2 \\ a, & x = 2 \\ bx + 4, & x > 2. \end{cases}$$

What values of a and b will make f continuous at 2? Explain your answer.

10. (10 pts.) In the figure, let \vec{a} be the vector from O to A , and let \vec{b} be the vector from O to B . Suppose that C and D divide the line segment \overline{AB} into equal thirds. Find the vector which starts at O and goes to C in terms of \vec{a} and \vec{b} .

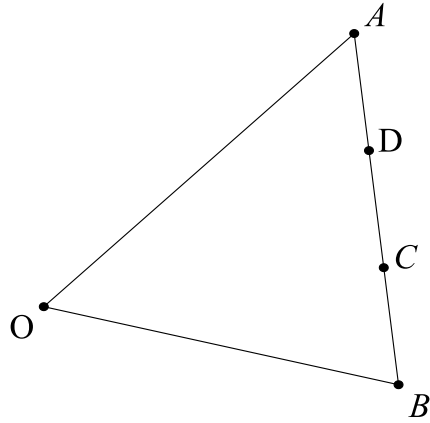


Figure for problem 10