Calculus

Name: Date:

# 1D Exercises

## Infinite Limits (And applications)

1. $\lim_{x\to-\infty} \frac{3x^3-2x+4}{x^3+x^2-1}$

2. $\lim_{x\to\infty} \frac{4x^4+2x^3-1005}{(3x^2+2)^2}$

3. $\lim_{x\to\infty} \frac{2x-3}{x^2+6}$

4. $\lim_{x\to-\infty} \frac{15x^{301}}{x^{300}+3x^{299}}$

5. Use your calculator to find this limit numerically

$$\lim_{x\to\infty} \left(1+\frac{1}{n}\right)^n =$$

***Here are some good limit practice problems to tie it all together!***

6. Here's a modified part of an example from the Free Response portion of the 2007 AP exam.

| $x$ | $f(x)$ | $g(x)$ |
|---|---|---|
| 1 | 6 | 2 |
| 2 | 9 | 3 |
| 3 | 10 | 4 |
| 4 | −1 | 6 |

The functions $f$ and $g$ are continuous for all real numbers. The table above gives values of the functions and their first derivatives at selected values of $x$. The function $h$ is given by $h(x)=f(g(x))-6$.

Explain why there must be a value $r$ for $1<r<3$ such that $h(r)=-5$.

7. If $f(x)=x^3-x^2+x$, show that there is a number $x=c$ on some interval $(a,b)$ such that $f(c)=10$.

Give the interval $(a,b)$ in your answer.

8. Given the two functions $f$ and $h$, such that

$$f(x) = x^3 - 3x^2 - 4x + 12 \qquad \text{and} \qquad h(x) = \begin{cases} \dfrac{f(x)}{x-3}, & x \neq 3 \\ p, & x = 3 \end{cases}$$

(a) Find all the zeros of $f$.

(b) Find the value of $p$ so that the function $h$ is continuous at $x = 3$. Justify.

9. For $f(x) = \begin{cases} cx^2 - 3, & x \leq 2 \\ cx + 2, & x > 2 \end{cases}$, find the value of $c$ to make $f$ continuous at $x = 2$.

10. If $f(x) = \begin{cases} \dfrac{\sqrt{2x+5} - \sqrt{x+7}}{x-2}, & x \neq 2 \\ k, & x = 2 \end{cases}$, and if $f$ is continuous at $x = 2$, then $k =$