## OTHER TYPES OF INDETERMINATE FORMS

**1.** <u>QUOTIENTS</u>: So far we have primarily looked at <u>INDETERMINATE FORMS</u> that are quotients:  $\frac{0}{0}, \frac{\pm \infty}{\pm \infty}$ . Hence, the following quotients are <u>DETERMINATE FORMS</u>, meaning you know the limit. Indicate the following limits, for a constant  $c \neq 0$  [Note: You may indicate  $\pm \infty$ ]:

(a). 
$$\frac{c}{0} \to \pm \infty$$
 (b).  $\frac{0}{c} \to 0$  (c).  $\frac{\pm \infty}{c} \to \pm \infty$  (d).  $\frac{c}{\pm \infty} \to 0$ 

2. PRODUCTS. Only one of the following products gives an indeterminate form. Cirle this one and then state the value of the limit for the other four forms.

 $0 \cdot \pm \infty$  IND  $c \cdot 0 = 0$   $c \cdot \pm \infty = \pm \infty$   $\infty \cdot \infty = \infty$   $-\infty \cdot \infty = -\infty$ 

3. SUMS AND DIFFERENCES. Only one of the following gives and indeterminate form. Circle this one and then state the value of the limit for the other two forms.

$$-\infty - \infty = -\infty$$
  $\infty - \infty$  IND  $\infty + \infty = \infty$ 

4. <u>POWERS</u>. Fill in the following blanks. The following two powers are <u>DETERMINATE FORMS</u>:

 $0^{\infty}$  $0^{-\infty}$ 

(a). Zero multiplied by itself over and over is still <u>zero</u>. So in the limit  $0^{\infty}$ , we get <u>0</u> since it doesn't matter whether you approach zero from above or below, it still goes to zero.

**(b)**.  $0^{-\infty} = \frac{1}{0^{\infty}} = \frac{1}{0} \to \pm \infty$ 

The following three powers are <u>INDETERMINATE FORMS</u>:  $0^0$  $1^{\infty}$ 

- (a). Zero raised to any number should still be zero . But any number raised to the zero should be one. So  $0^0$  is INDETERMINATE because "reason" gives two plausible answers.
- (b). Infinity (or a really big number) raised to a power should still be a really big number , but any number raised to the zero should be <u>one</u>. So  $\infty^0$  is INDETERMINATE because "reason" gives two plausible answers.
- (c). 1.00001 multiplied by itself over and over will get larger. But 0.99999 multiplied by itself over and over will get <u>smaller</u>. So the limit  $1^{\infty}$  is also an <u>INDETERMINATE</u> form.