Circle True or False. (1 point for correct answer, 0 if incorrect)

1. True   **FALSE** If we take $\lim\limits_{x\to\infty} f(x)^{g(x)}$ and get 1^∞, then the limit is 1.

> **Solution:** We need to change it to use L'Hopital's Rule.

2. True   **FALSE** If we take $\lim\limits_{x\to\infty} f(x)^{g(x)}$ and get 0^∞, then we need to use L'Hopital's Rule.

> **Solution:** The limit is then 0.

Show your work and justify your answers. Please circle or box your final answer.

3. (10 points)   (a) (3 points) Find $\lim\limits_{x\to 0} \dfrac{x\tan x}{\sin 3x}$.

> **Solution:** Plugging in $x = 0$ gives $0/0$ so using Lhopitals gives
> $$\lim_{x\to 0} \frac{x\tan x}{\sin 3x} = \lim_{x\to 0} \frac{x\sec^2(x) + \tan x}{3\cos(3x)} = \frac{0}{3} = 0.$$

(b) (7 points) Sand is being dumped in a conical pile whose width and height always remain the same. If the sand is being dumped in at a rate of $5\pi cm^3/min$, how fast is the height of the sand changing when the pile is $10cm$ tall?

> **Solution:** Let the height of the pile be h. Then the radius of the pile is $r = \frac{h}{2}$ and the volume of the pile is $V = \frac{\pi r^2 h}{3} = \frac{\pi h^3}{12}$. Taking the derivative gives $V' = \frac{\pi}{4}h^2 h'$. Now we plug in 5π for V' and 10 for h to get $h' = \frac{20\pi}{100\pi} = \frac{1}{5}$ cm/min.