1. (a) and (b)

For $a=0$, the linear approx of $f(x)=(1+x)^n$ at $a=0$ is

$$L(x) = f(a) + f'(a)(x-a)$$
$$= 1 + n\cdot(x-0)$$
$$= 1+nx$$

(c) Percentage Error $= 100 \cdot \dfrac{|x^2+2x+1-(2x+1)|}{x^2+2x+1}$

$$= \frac{100x^2}{x^2+2x+1}$$

$$\frac{100x^2}{x^2+2x+1} = 5 \iff 19x^2-2x-1=0$$
$$\iff x = \frac{1 \pm 2\sqrt{5}}{19}$$

The percentage error is $\leq 5\%$ if x in $\left[\frac{1-2\sqrt{5}}{19}, \frac{1+2\sqrt{5}}{19}\right]$.

2. (a)

$\tan(0.2) = f(0.2)$ where $f(x)=\tan(x)$.

$$\tan(0.2) \approx f(0) + f'(0)(0.2-0)$$
$$= 0 + 1\,(0.2)$$
$$= 0.2$$

(b) $\sqrt{65} = f(65)$ where $f(x)=\sqrt{x}$.

$$\sqrt{65} \approx f(64) + f'(64)(65-64)$$
$$= 8 + \frac{1}{16}(1)$$
$$= \frac{129}{16}$$

(c) $\ln(1.1) = f(1.1)$ where $f(x)=\ln(x)$

$$\ln(1.1) \approx f(1) + f'(1)(1.1-1)$$
$$= 0 + 1\,(.1)$$
$$= .1$$