$$\boxed{4/16/15}$$

1. See solutions from 4/14/15.

2. $$\lim_{x\to 0^+} \cot(x)^{2x} = \lim_{x\to 0^+} e^{\ln(\cot x)\cdot 2x} = \exp\left\{\lim_{x\to 0^+} 2x \ln(\cot x)\right\}$$

$$= \exp\left\{2\lim_{x\to 0^+} \frac{\overbrace{\ln(\cot(x))}^{\to\infty}}{\underbrace{\frac{1}{x}}_{\to\infty}}\right\} \underset{\text{l'Hôp}}{=} \exp\left\{2\lim_{x\to 0^+} \frac{\frac{1}{\cot(x)}\cdot \csc^2(x)}{\frac{-1}{x^2}}\right\}$$

$$= \exp\left\{2\lim_{x\to 0^+} \frac{-x^2 \cancel{\sin(x)}}{\cos(x)\sin^{\cancel{2}}(x)}\right\} = \exp\left\{2\lim_{x\to 0^+}\frac{x}{\sin(x)}\lim_{x\to 0^+}\frac{-x}{\cos(x)}\right\}$$

$$= \exp\{2\cdot 1\cdot 0\} = e^0 = \boxed{1}$$

3. (c) and (d).

4. $$\frac{d}{dx}\left[2\ln\left(\frac{x}{e^x+1}\right)\right] = \frac{d}{dx}\left[2\ln(x) - 2\ln(e^x+1)\right]$$

$$= \boxed{\frac{2}{x} - \frac{2}{e^x+1}\cdot e^x}$$

5. $$\boxed{\int_a^b f(x)\,dx = \lim_{n\to\infty}\sum_{i=0}^{n-1} f\left(a+i\,\frac{b-a}{n}\right)\cdot\frac{b-a}{n}}$$

⑥ ⓐ $\int_0^{\pi/4} \sec^2\theta \, d\theta = \tan\theta \Big|_0^{\pi/4} = \tan\left(\frac{\pi}{4}\right) - \tan(0) = \boxed{1}$

ⓑ $\int_{-1}^{1} |x| \, dx = \int_{-1}^{0} |x| \, dx + \int_0^1 |x| \, dx$

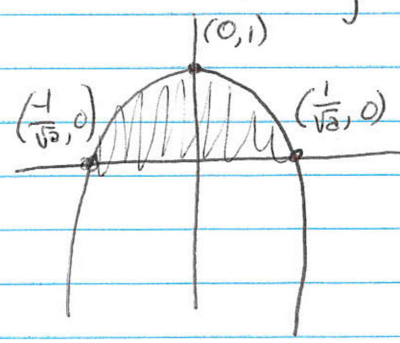
$= \int_{-1}^{0} -x \, dx + \int_0^1 x \, dx = \left[-\frac{1}{2}x^2\right]_{-1}^{0} + \left[\frac{1}{2}x^2\right]_0^1$

$= \left[0 - \left(\frac{-1}{2}\right)\right] + \left[1/2 - 0\right] = \frac{1}{2} + \frac{1}{2} = \boxed{1}$

ⓒ $\int_2^4 \frac{2}{x} = 2\ln(x)\Big|_2^4 = 2\ln(4) - 2\ln(2)$

$= 2\ln\left(\frac{4}{2}\right) = \boxed{2\ln(2)}$

⑦ $1 = \int_{-1/\sqrt{a}}^{1/\sqrt{a}} 1 - ax^2 \, dx$



$y = 1 - ax^2$

$0 = 1 - ax^2$

$ax^2 = 1$

$x^2 = \frac{1}{a}$

$x = \frac{\pm 1}{\sqrt{a}}$

$= \left[x - \frac{a}{3}x^3\right]_{-1/\sqrt{a}}^{1/\sqrt{a}}$

$= \left[\frac{1}{\sqrt{a}} - \frac{a}{3}\frac{1}{(\sqrt{a})^3}\right] - \left[\frac{-1}{\sqrt{a}} - \frac{a}{3}\left(\frac{-1}{(\sqrt{a})^3}\right)\right]$

$= \frac{2}{\sqrt{a}} - \frac{2\cancel{a}}{3\cancel{a}\sqrt{a}} = \frac{4}{3\sqrt{a}} \Rightarrow 3\sqrt{a} = 4$

$\Rightarrow \sqrt{a} = 4/3 \Rightarrow \boxed{a = 16/9}$