

(1) [7 points] Solve for x :

$$e^{x^2} = e^{3x} \cdot \frac{1}{e^2}$$

$$e^{x^2} = e^{3x-2}$$

$$x^2 = 3x - 2$$

$$x^2 - 3x + 2 = 0$$

$$(x-1)(x-2) = 0$$

$$\boxed{x=1, \quad x=2}$$

(2) [4 points] Determine the domain of $f(x) = 3 - 2\log_4 \left[\frac{x}{2} - 5 \right]$.

$$\text{Require } \frac{x}{2} - 5 > 0$$

$$\frac{x}{2} > 5$$

$$x > 10$$

\therefore Domain of $f(x)$ is $(10, \infty)$.

(3) [4 points] Solve for x :

$$\log_3(x^2 + 1) = 2$$

$$\therefore 3^2 = x^2 + 1$$

$$x^2 = 8$$

$$x = \pm \sqrt{8}$$

$$= \boxed{2\sqrt{2}, -2\sqrt{2}}$$