Use the Fundamental Theorem of Calculus to evaluate each expression.

For each function, suppose $F(x)$ is an antiderivative of it.

1. $\frac{d}{dx}\int_2^x \sin^2 t \cos t \, dt$

$= \frac{d}{dx}\left[F(x) - F(2)\right] = \boxed{\sin^2 x \cos x}$

2. $\frac{d}{dx}\int_0^x e^t \cos t^2 \, dt$

$= \frac{d}{dx}\left[F(x) - F(0)\right] = \boxed{e^x \cos x^2}$

3. $\frac{d}{dx}\int_2^{x^2} t^2 - e^{2t} \, dt$ $= \frac{d}{dx}\left[F(x^2) - F(2)\right] = 2x\left[(x^2)^2 - e^{2x^2}\right]$

$= \boxed{2x^5 - 2xe^{2x^2}}$

4. $\frac{d}{dx}\int_1^{\sin x} t^3 \cos t \, dt$ $= \frac{d}{dx}\left[F(\sin x) - F(1)\right] = \boxed{\cos x\left[\sin^3 x \cos(\sin x)\right]}$

5. $\frac{d}{dx}\int_x^{x^2} t^3 - t^2 \, dt$ $= \frac{d}{dx}\left[F(x^2) - F(x)\right] = 2x\left[(x^2)^3 - (x^2)^2\right] - (x^3 - x^2)$

$= \boxed{2x^7 - 2x^5 - x^3 + x^2}$

6. $\frac{d}{dx}\int_x^7 \cos(2t) - t \, dt$ $= -\frac{d}{dx}\int_7^x \cos(2t) - t \, dt$

$= -\frac{d}{dx}\left[F(x) - F(7)\right] = -\left[\cos(2x) - x\right] = \boxed{x - \cos 2x}$

7. $\frac{d}{dx}\int_{x^3}^3 3^t - \sin t \, dt$ $= \frac{d}{dx}\left[F(3) - F(x^3)\right] = \boxed{-3x^2\left(3^{x^3} - \sin x^3\right)}$

8. $\frac{d}{dx}\int_{2x}^{3x^2} \tan t \, dt$ $= \frac{d}{dx}\left[F(3x^2) - F(2x)\right] = \boxed{6x \tan 3x^2 - 2\tan 2x}$

9. $\frac{d}{dx}\int_{x^2}^{e^x} e^{t^2} \, dt$ $= \frac{d}{dx}\left[F(e^x) - F(x^2)\right] = e^x\left[e^{(e^x)^2}\right] - 2x\left[e^{(x^2)^2}\right]$

$= \boxed{e^x e^{e^{2x}} - 2xe^{x^4}}$