

1. (a)

$$\int \left(\frac{2}{1+x^2} + 3 \right) dx = 2 \int \frac{1}{1+x^2} dx + 3 \cdot \int 1 dx$$

$$= 2 \tan^{-1}(x) + 3x + C$$

(b)

$$\int \frac{10t^{3/2} + 9}{t} dt = \int 10t^{1/2} + \frac{9}{t} dt$$

$$= 10 \int t^{1/2} dt + 9 \int \frac{1}{t} dt$$

$$= \frac{20}{3} t^{3/2} + 9 \ln(|t|) + C$$

(c)

$$\int \tan(\theta) (\cos(\theta) - \sec(\theta)) d\theta$$

$$= \int \sin(\theta) - \sec(\theta) \tan(\theta) d\theta$$

$$= \int \sin(\theta) d\theta - \int \sec(\theta) \tan(\theta) d\theta$$

$$= -\cos(\theta) - \sec(\theta) + C$$

2.

$$f'(x) = \int f''(x) dx$$

$$= \int 2 + 5e^x dx$$

$$= 2x + 5e^x + C$$

$$f'(0) = 1 \quad \text{tells us}$$

$$1 = 2 \cdot 0 + 5e^0 + C$$

$$-4 = C$$

$$f'(x) = 2x + 5e^x - 4$$

$$f(x) = \int f'(x) dx$$

$$= \int 2x + 5e^x - 4 dx$$

$$= x^2 + 5e^x - 4x + C$$

$$f(0) = 5 \quad \text{tells us}$$

$$5 = 0^2 + 5e^0 - 4 \cdot 0 + C$$

$$0 = C$$

$$f(x) = x^2 + 5e^x - 4x$$