Evaluate the following derivatives. You will have to make use of the chain rule, product rule, and quotient rule:

1. $\dfrac{d}{dx}\sin 3x$ ans. $3\cos 3x$

2. $\dfrac{d}{dx}\ln\left(\dfrac{x}{2}\right)$ ans. $\dfrac{1}{x}$

3. $\dfrac{d}{dx}\ln\left(\dfrac{1}{x}\right)$ ans. $-\dfrac{1}{x}$

4. $\dfrac{d}{dx}\left(\dfrac{x}{\ln x}\right)$ ans. $\dfrac{\ln x - 1}{(\ln x)^2}$

5. $\dfrac{d}{dx}\left(3x^2 e^{-2x}\right)$ ans. $6xe^{-2x}\left(1-x\right)$

6. $\dfrac{d}{dx}\left(3x^3 - 2x + \dfrac{1}{2}x^{-1}\right)$ ans. $9x^2 - 2 - \dfrac{1}{2}x^{-2}$

7. $\dfrac{d}{dx}\left[3\sin\left(x^2\right)\right]$ ans. $6x\,\cos\left(x^2\right)$

8. $\dfrac{d}{dx}\left(\sin x\,\cos x\right)$ ans. $\cos^2 x - \sin^2 x$

9. $\dfrac{d}{dx}\left(\sin^2 x\,\cos x\right)$ ans. $\sin x\left(2\cos^2 x - \sin^2 x\right)$

10. $\dfrac{d}{dx}\left(e^{e^x}\right)$ ans. $e^{(x+e^x)}$

11. $\dfrac{d}{dx}\left[\ln\left(\sqrt{x}\right)\right]$ ans. $\dfrac{1}{2x}$

12. $\dfrac{d}{dx}\left[\ln\left(2\sqrt{x}\right)\right]$ ans. $\dfrac{1}{2x}$

13. $\dfrac{d}{dx}\left[\ln\left(\sqrt{2x}\right)\right]$ ans. $\dfrac{1}{2x}$

14. $\dfrac{d}{dx}\left(\dfrac{\cos x}{\sin x}\right)$ ans. $-\dfrac{1}{\sin^2 x} = -\csc^2 x$

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

Evaluate the following integrals:

1. $\int_1^3 3x^2\,dx$ ans. 26

2. $\int_1^3 \left(3x^2-4x\right)\,dx$ ans. 10

3. $\int_0^b \left(-\frac{1}{2}e^x\right)\,dx$ ans. $\frac{1}{2}\left(1-e^b\right)$

4. $\int_1^2 \frac{1}{x}\,dx$ ans. $\ln(2)$

5. $\int_{-\pi/4}^{\pi/2} \sin x\,dx$ ans. $\frac{1}{\sqrt{2}}$

6. $\int_{\pi/3}^{3\pi/4} \cos x\,dx$ ans. $\frac{\sqrt{2}-\sqrt{3}}{2}$

7. Given that $\frac{d}{dx}\left(\frac{x}{\ln x}\right)=\frac{\ln x-1}{\left(\ln x\right)^2}$, use the fundamental theorem of calculus to evaluate $\int_2^5 \frac{\ln x-1}{\left(\ln x\right)^2}\,dx$.
   ans. $\frac{5\ln 2-2\ln 5}{\left(\ln 5\right)\left(\ln 2\right)}$