Practice Assessment

The Fundamental Theorem of Calculus

These **practice problems** are designed to help you **prepare for our course exams** and **assess your understanding** of the course material at the expected level. Aim to complete them **in class, during tutoring, office hours, or on your own**, and try to solve them **without notes or a calculator**, just like on the **actual exams**. Remember, **practice makes perfect**, so don't hesitate to **ask for help** if you get stuck.

1. Use the Fundamental Theorem of Calculus to compute the following, without integrating anything.

   (a) $\dfrac{d}{dx}\displaystyle\int_0^x \sqrt{1+t^2}\,dt$

   (b) $\dfrac{d}{dy}\displaystyle\int_1^y 3x^2\,dx$

   (c) $\dfrac{d}{dz}\displaystyle\int_z^5 \sin\left(y^2\right)\,dy$

   (d) $\dfrac{d}{dw}\displaystyle\int_w^{-2} \sec\left(z^3\right)\,dz$

Problem 1 Continued.

(e) $\dfrac{d}{dv}\displaystyle\int_7^{v^2} \ln\left(w^2+1\right)\, dw$

(f) $\dfrac{d}{du}\displaystyle\int_3^{u^3+u} \tan\left(v\right)\, dv$

(g) $\dfrac{d}{ds}\displaystyle\int_{\sqrt{s}}^{6} \dfrac{u^2}{u^2+4}\, du$

(h) $\dfrac{d}{dr}\displaystyle\int_{\cos(r)}^{\sin(r)} e^{s^2}\, ds$

(i) $\dfrac{d}{dt}\displaystyle\int_{\sqrt{t}}^{t^2} \sin^{-1}\left(r\right)\, dr$

2. Compute the following integrals.

(a) $\int_{-1}^{2} (3x^2 - 2x + 1)\, dx$

(b) $\int_{-1}^{0} (x - x^2)\, dx$

(c) $\int 2\sec^2(\theta)\, d\theta$

(d) $\int (y + 1)^2\, dy$

(e) $\displaystyle\int_1^{\sqrt{2}} \frac{t^2+\sqrt{2}}{t^2}\,dt$

(f) $\displaystyle\int \frac{z^5-2z}{z^3}\,dz$

(g) $\displaystyle\int_0^{1/2} \frac{4}{\sqrt{1-x^2}}\,dx$

(h) $\displaystyle\int_0^{\pi/3} (\sec(\theta)+\tan(\theta))\,d\theta$