Practice Assessment 2
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) $\dfrac{d}{dv}\displaystyle\int_{7}^{v^2} \ln\left(w^2+1\right)\,dw$

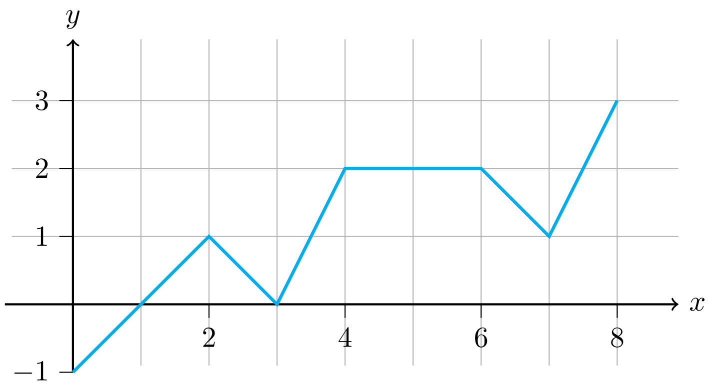
(f) $\dfrac{d}{du}\displaystyle\int_{3}^{u^3+u} \tan\left(v\right)\,dv$

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

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

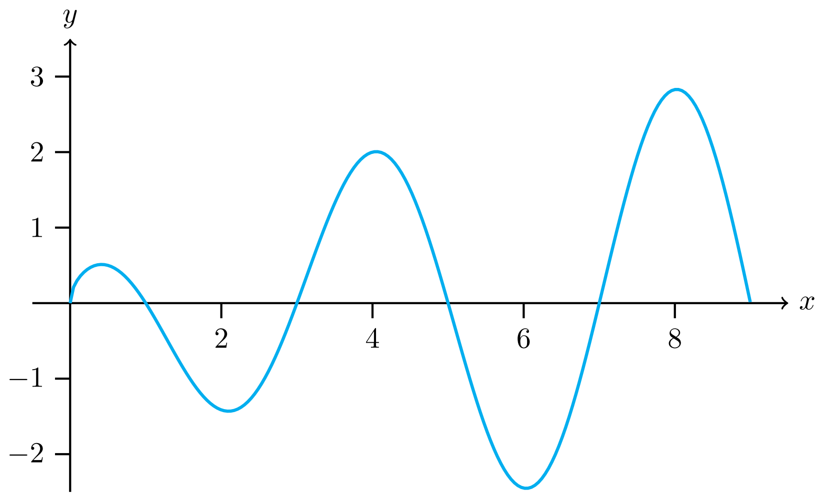
(i) $\dfrac{d}{dt}\displaystyle\int_{\sqrt{t}}^{t^2} \sin^{-1}\left(r\right)\,dr$

2. Find the average value of f, graphed below, on $[0, 8]$.



3. If $p(q)$ is an even function with $\int_0^3 p(q)\,dq = 6$, then the average value of $p(q)$ on the interval $[-3, 3]$ is ______________.

4. Let $g(x) = \int_0^x f(t)\, dt$, where f is the function whose graph is shown.



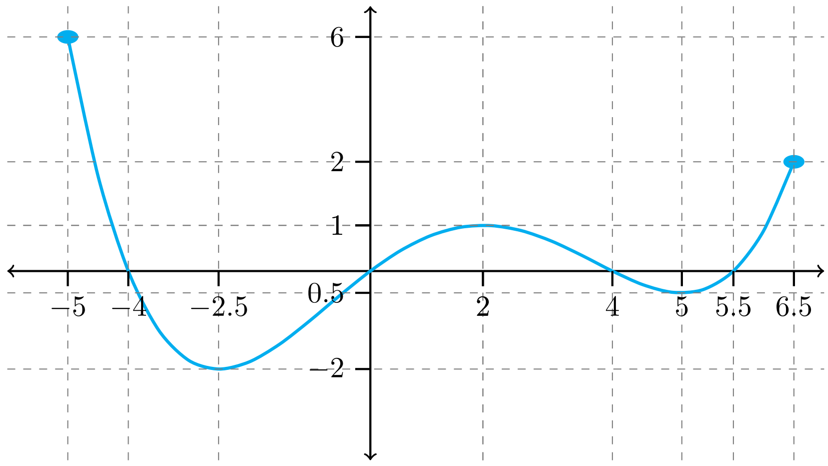
(a) At what values of x do the local maximum and minimum values of g occur.

(b) Where does g attain its absolute maximum value?

(c) On what intervals is g concave downward?

(d) Sketch the graph of g.

5. The graph of $f(t)$, defined on the interval $[-5, 6.5]$, is given below. Define a function by $h(x) = \int_{-5}^{x} f(t)\,dt$ for $-5 \le x \le 6.5$.



(a) Determine the interval(s) where $h(x)$ is increasing.

(b) Determine the critical points of $h(x)$.

(c) Find all local maximum points.

(d) Determine the interval(s) where $h(x)$ is concave down.