2. An object moves in a straight line. Its acceleration at t seconds, in m/s^2, is given by

$$a(t) = \cos(2t).$$

The velocity of this object at $t = \pi/4$ seconds is $v(\pi/4) = 0$ m/s.

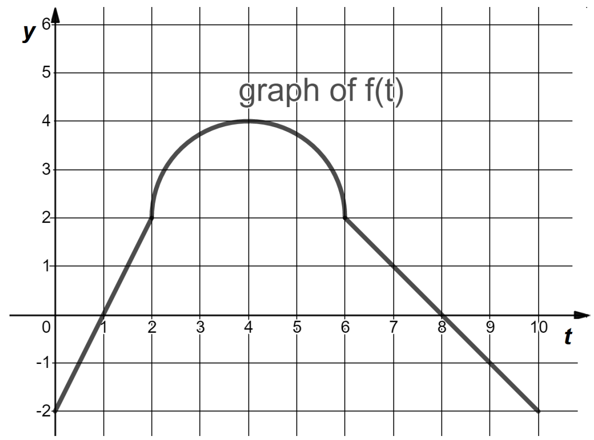
(a) (4 points) Compute the value of $\int_{\pi/4}^{\pi/2} a(t)dt$. Include **units** in your answer, and, in one brief sentence, state what this value represents, in terms of the motion of the object.

(b) (3 points) Compute the velocity $v(t)$ of this object at t seconds, as a function of t.

(c) (3 points) Compute the displacement (change in position) of the object, in meters, from 0 to $\pi/2$ seconds.

3. The following is the graph of a function $y = f(t)$, for $0 \leq t \leq 10$, consisting of two line segments and a semicircle. We use it to define a new function, for $0 \leq x \leq 10$:

$$F(x) = \int_0^x f(t)\,dt$$



Indicate how you get your answers in part (a).
You need not justify parts (b)-(e) below.

(a) (5 points) Calculate $F(4)$, $F'(4)$, and $f'(4)$.

(b) (1 point) At what value of x in $[0, 10]$ does $F(x)$ reach its absolute maximum?

(c) (2 points) What is the absolute minimum of $F(x)$ over the interval $[0, 10]$?

(d) (1 point) At what value of x in $[0, 10]$ does $\frac{dF}{dx}$ reach its absolute maximum value?

(e) (1 point) On the interval $(0, 2)$, is the graph of $F(x)$ concave up, concave down, neither, or cannot tell?

4. (6 points) Evaluate the following integral. Show all steps.

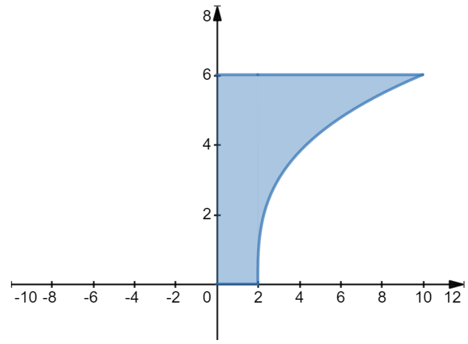
$$\int \frac{2}{\sqrt{x}\,(2+\sqrt{x})^{41}}\,dx$$

5. (4 points) Write the following limit of a Riemann Sum as a definite integral of a function over an interval.

$$\lim_{n\to\infty}\sum_{i=1}^{n}\left(\sin\left(1+\frac{i}{n}\right)\cos\left(1+\frac{i}{n}\right)\frac{1}{n}\right)$$

6. Consider the region R shaded on the graph below. It is bounded by the following curves:

   the x-axis, the y-axis, $y = 6$, and $y = 3(x-2)^{1/3}$.



   (a) (3 points) Set up an integral expression in terms of x equal to the area of this region. Do not evaluate.

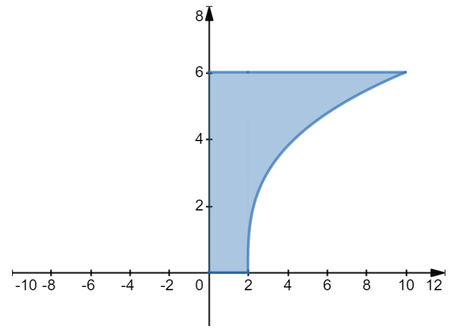
   (b) (3 points) Set up an integral expression in terms of y equal to the area of this region. Do not evaluate.

   (c) (4 points) Compute the area of the region by evaluating either of your integrals above.

7. Consider the same region R as in the previous problem, bounded by the curves:

$$\text{the } x\text{-axis, the } y\text{-axis, } y = 6, \text{ and } y = 3(x-2)^{1/3}.$$

(a) (4 points) SET UP (do not evaluate or simplify) an integral equal to the volume of the solid of revolution obtained by rotating this region around the x-axis



(b) (4 points) SET UP (do not evaluate or simplify) an integral equal to the volume of the solid of revolution obtained by rotating this region around the vertical line $x = -4$.