

5.4

5.4 The Fundamental Theorem of Calculus

Part 1

RS #29: $\frac{d}{dx} \int_c^x f(t) dt = f(x)$

Find $\frac{dy}{dx}$

1. $y = \int_{\pi}^x \cos t dt$

2. $y = \int_{-1}^x (t^2 + t - 1) dt$

3. $y = \int_4^{x^2} e^t dt$

5. $y = \int_{e^x}^{x^2} \ln t dt$

4. $y = \int_{2x}^{x^2} \sin t dt$

5.4

Part 2

$$\int_a^b f(x) dx = [F(x)]_a^b = F(b) - F(a)$$

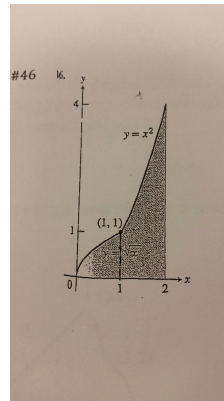
6. $\int_1^4 x^{\frac{2}{3}} dx$

7. $\int_0^2 \frac{\sqrt{x+3}}{\sqrt{x}} dx$

Find the total area between the curve and the x-axis analytically. Support your answers graphically.

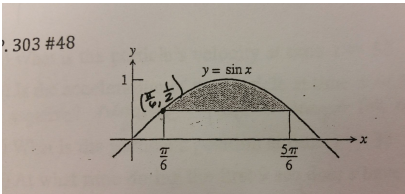
8. $y = 4 - x^2$, $[0, 3]$

9. $y = x^3 - 4x$, $[-2, 2]$



5.4

P. 303 #48



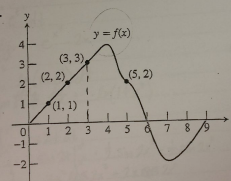
P. 304 #58

In Exercises 58 and 59, f is the differentiable function whose graph is shown in the given figure. The position at time t (sec) of a particle moving along a coordinate axis is

$$s = \int_0^t f'(x) dx$$

meters. Use the graph to answer the questions. Give reasons for your answers.

58.



- a) What is the particle's velocity at time $t=5$?
- b) Is the acceleration of the particle at time $t=5$ positive or negative?
- c) What is the particle's position at time $t=3$?
- d) At what time during the first 9 sec does s have its largest value?
- e) Approximately when is the acceleration zero?
- f) When is the particle moving toward the origin? away from the origin?
- g) On which side of the origin does the particle lie at time $t=9$?