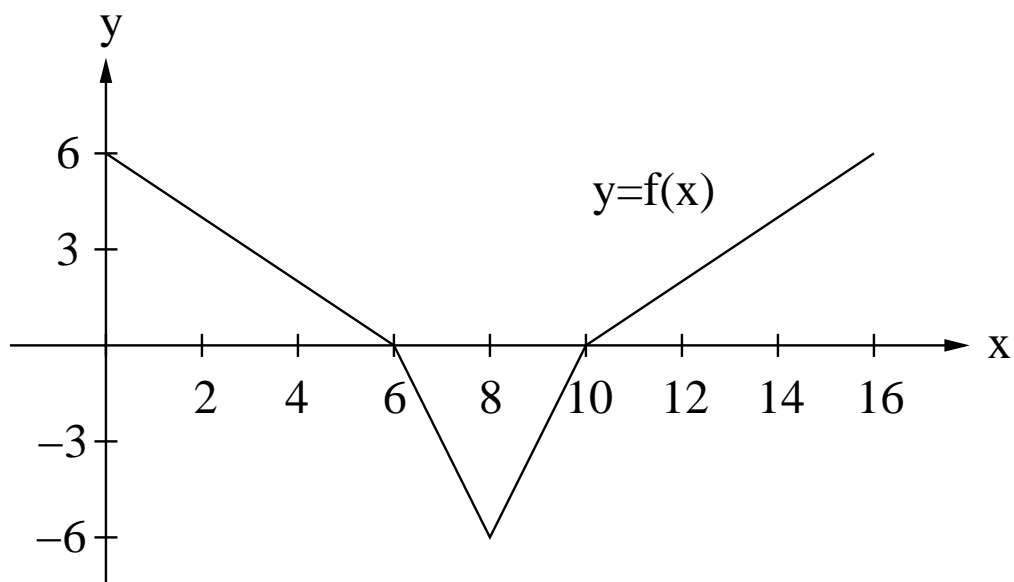


Name \_\_\_\_\_

1. (10 points) Evaluate the following definite integrals.

(a)  $\int_0^2 \frac{100x}{x^2 + 1} dx$

(b)  $\int_1^3 e^{2x+3} dx$



2. (10 points) The graph of  $f(x)$  is shown above. The definite integral,  $\int_0^{16} f(x) dx$ , is equal in value to one of the choices below. Which one? Circle your answer.

- (a) 0
- (b) 6
- (c) 12
- (d) 18
- (e) 24
- (f) 30
- (g) 36
- (h) 42
- (i) 48
- (j) 56
- (k) 64

3. (10 points) Sal loves blueberries and at 9:00 A.M., she started eating some at a rate of  $50 - 5 \ln(t + 1)$  blueberries per minute, where  $t$  denotes the number of minutes since 9:00 A.M. What is the total number of blueberries that Sal ate between 10:00 A.M. and 11:00 A.M. ?

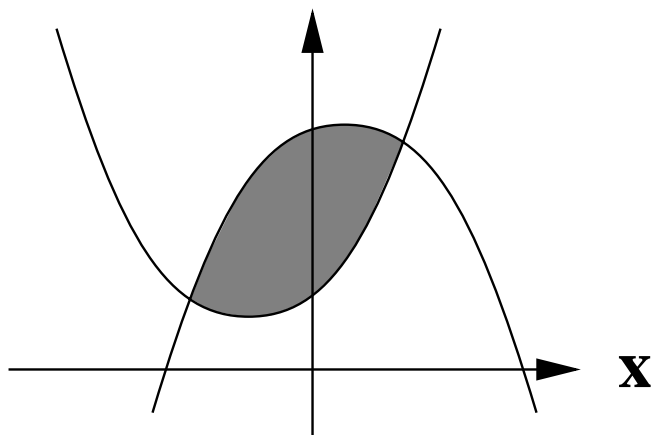
4. (10 points) Oil is leaking from a ruptured tanker at an increasing rate. The rates are recorded in the table below every 5 minutes since the tanker was first ruptured.

time (minutes)	0	5	10	15	20
rate (gallons per minute)	80	90	105	125	150

- (a) Use the information above to give the best possible overestimate to the number of gallons of oil which have leaked during the first 20 minutes after the tanker was ruptured.

- (b) Use the information above to give the best possible underestimate to the number of gallons of oil which have leaked during the first 20 minutes after the tanker was ruptured.

5. (10 points) The graphs of  $f(x) = 3 + 2x + x^2$  and  $g(x) = 9 + x - x^2$  are sketched below and the area between the two curves is shaded in. Find the **exact area** of this shaded region. Your final answer should be correct to one place after the decimal point and you must show sufficient work to justify your answer.



6. (10 points) An engineer tests the strength of a material as its temperature changes over a 40-minute period from its initial temperature of  $25.3^{\circ}F$  to its final temperature 40 minutes later. During her test, the material's temperature, in degrees Fahrenheit ( $^{\circ}F$ ), is approximated by the function  $f(t) = 0.006t^3 + 0.14t^2 + 25.3$  where  $t$  represents the number of minutes since she began her test.

(a) What is the temperature of the material 20 minutes after she began her test?

(b) How quickly is the temperature of the material rising 20 minutes after she began her test?

7. (10 points) At 4:00 AM on January 1, 2002, the layer of ice on Lake Mendota was 6 inches thick. Its thickness was changing at a rate of  $0.2t$  inches per hour where  $t$  represents the number of hours since 4:00 AM. How thick was the ice at noon that same day?

8. (10 points) The marginal cost of a product, in dollars per item, is  $C'(q) = q^2 - 30q + 600$ . If fixed costs are \$300, find the total cost to produce 40 items. You must show sufficient work to justify your answer.

9. (5 points) Which one of the following most clearly states the Fundamental Theorem of Calculus?

(a) Rate of change of a quantity from  $t = a$  to  $t = b$  equals  $\int_a^b$  (total change in that quantity)  $dt$

(b) Rate of change of a quantity from  $t = a$  to  $t = b$  equals  $\int_b^a$  (total change in that quantity)  $dt$

(c) Rate of change of a quantity from  $t = a$  to  $t = b$  equals  $\int_a^b$  (rate of change of that quantity)  $dt$

(d) Rate of change of a quantity from  $t = a$  to  $t = b$  equals  $\int_b^a$  (rate of change of that quantity)  $dt$

(e) Total change in a quantity from  $t = a$  to  $t = b$  equals  $\int_a^b$  (rate of change of that quantity)  $dt$

(f) Total change in a quantity from  $t = a$  to  $t = b$  equals  $\int_b^a$  (rate of change of that quantity)  $dt$

(g) Total change in a quantity from  $t = a$  to  $t = b$  equals  $\int_a^b$  (total change in that quantity)  $dt$

(h) Total change in a quantity from  $t = a$  to  $t = b$  equals  $\int_b^a$  (total change in that quantity)  $dt$

10. (5 points) Which one of the following most clearly states the Fundamental Theorem of Calculus?

(a)  $\int_a^b F(t) dt = F'(b) - F'(a)$

(b)  $\int_a^b F(t) dt = F'(a) - F'(b)$

(c)  $\int_a^b F(t) dt = F(b) - F(a)$

(d)  $\int_a^b F(t) dt = F(a) - F(b)$

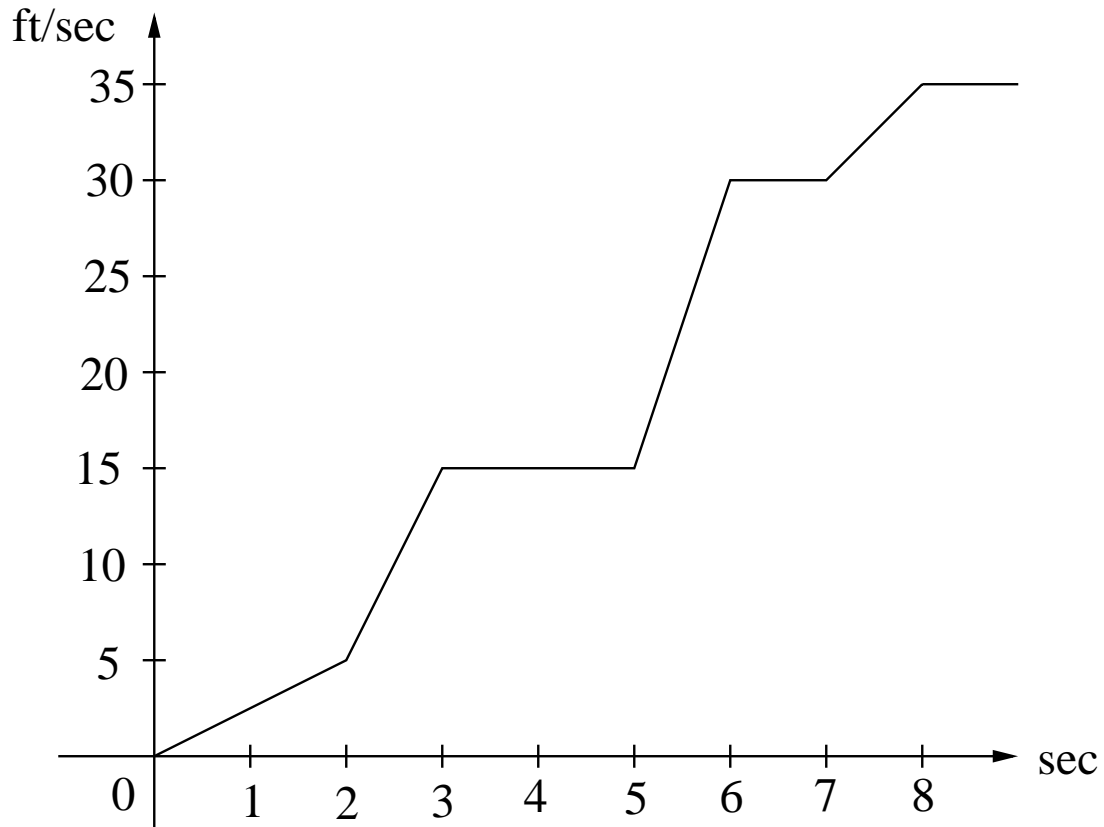
(e)  $\int_a^b F'(t) dt = F'(b) - F'(a)$

(f)  $\int_a^b F'(t) dt = F'(a) - F'(b)$

(g)  $\int_a^b F'(t) dt = F(b) - F(a)$

(h)  $\int_a^b F'(t) dt = F(a) - F(b)$

11. (10 points) With Thanksgiving quickly approaching, George W. Turkey has wisely decided to escape from the turkey farm. The open front gate is 30 feet away. He runs in the direction of the gate and his velocity (in feet per second) is given in the graph shown below. How many seconds does it take until he has made it to the gate? Note: He keeps running even after he's made it past the gate.



12. (1 Bonus Point) Have a Happy Thanksgiving!