Name: _____ Date: _____

1. The rate of pollution pouring into a lake is measured every 10 days, with results in the following table. About how many tons of pollution have entered the lake during the first 40 days?

| Time in days	0	10	20	30	40
Rate of pollution in tons/day	5	7	10	9	9

2. If $\int_0^3 f(x)\,dx = 9$, $\int_0^3 g(x)\,dx = 2$, and $\int_3^5 f(x)\,dx = 12$, find the value of $\int_0^5 f(x)\,dx$.

3. If $\int_0^3 f(x)\,dx = 6$, $\int_0^3 g(x)\,dx = 4$, and $\int_3^5 f(x)\,dx = 15$, find the value of

$\int_0^3 (f(x) + g(x))\,dx$.

4. Suppose $f(t)$ is given by the following graph. If $F(x) = \int_0^x f(t)\,dt$, what is $F(5)$?
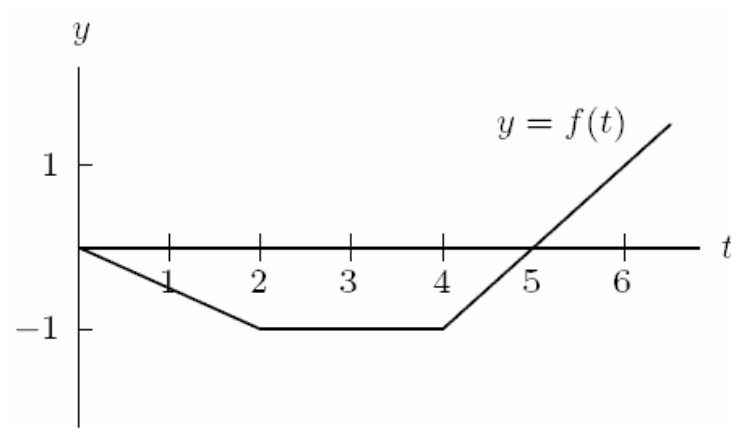
5. An air conditioning unit is switched on in an $80°$ F room. The room is cooling off at a rate of $r(t) = 2(0.8)^t$ degrees F per minute, with t in minutes after the unit was turned on. Set up an appropriate integral and evaluate it with a calculator to find the temperature of the room after 10 minutes. Round to the nearest degree.

6. Below is a graph of the rate r in arrivals per minute at which students line up for breakfast. The first people arrive at 6:50 am and the line opens at 7:00 am. The line serves students at a constant rate of 20 students per minute. Estimate the length of the line at 7:20.
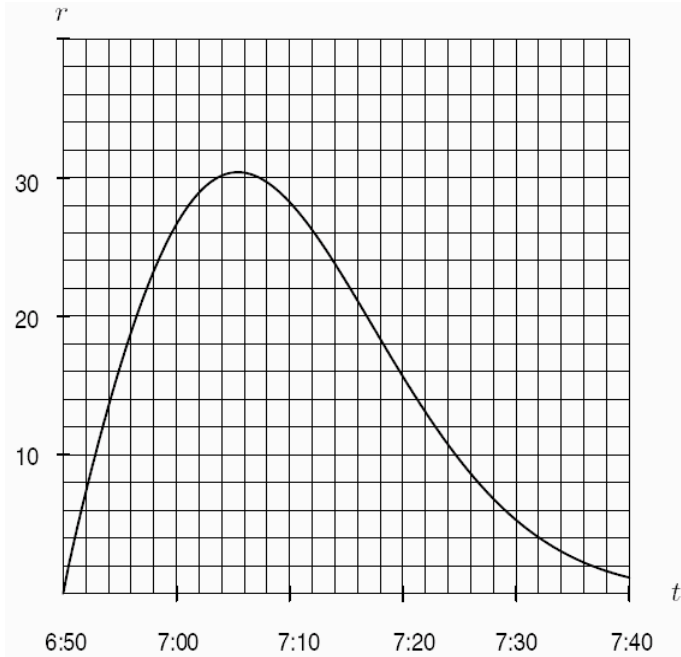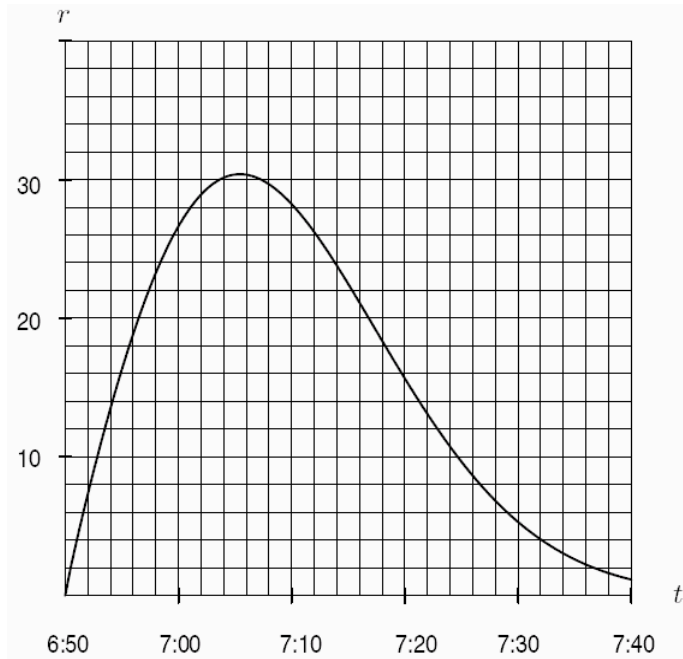

A) 250
B) 350
C) 450
D) 550

7. Below is a graph of the rate r in arrivals per minute at which students line up for breakfast. The first people arrive at 6:50 am and the line opens at 7:00 am. The line serves students at a constant rate of 20 students per minute. Estimate the rate at which the line is growing in length at 7:12
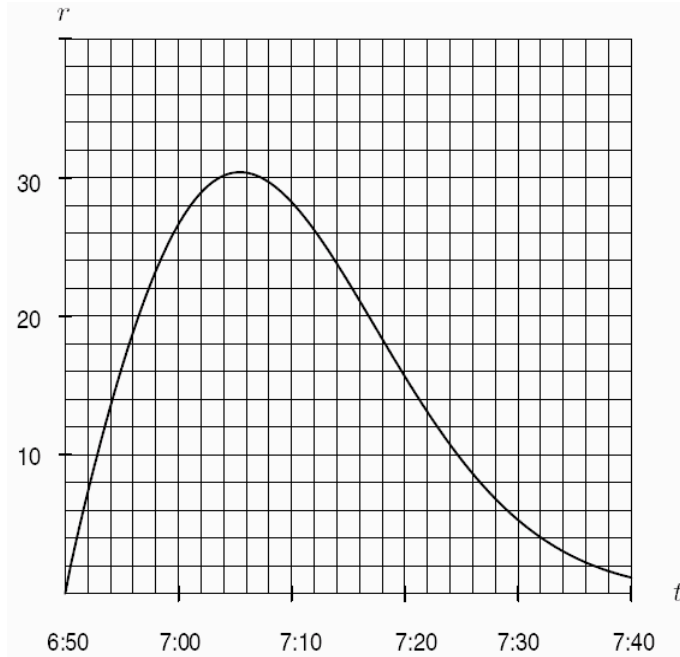

A) 4 people per minute
B) 6 people per minute
C) 12 people per minute
D) 26 people per minute

8. Below is a graph of the rate r in arrivals per minute at which students line up for breakfast. The first people arrive at 6:50 am and the line opens at 7:00 am. The line serves students at a constant rate of 20 students per minute. Estimate the time at which the line disappears.


A) 7:10 am or earlier
B) 7:20 am
C) 7:30 am
D) 7:40 am or later

9. Below is a graph of the rate r in arrivals per minute at which students line up for breakfast. The first people arrive at 6:50 am and the line opens at 7:00 am. The line serves students at a constant rate of 20 students per minute. Estimate the length of time a person who arrives at 7:00 has to stand in line.
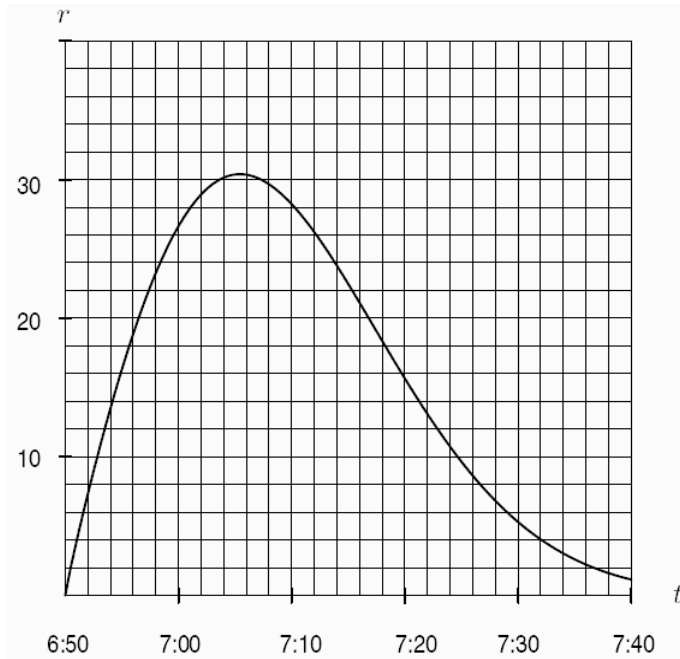

A) 1.5 minutes
B) 3.5 minutes
C) 7.5 minutes
D) 11.5 minutes

10. The marginal cost function of producing a particular product is given by $C'(q) = 1000 - 20q$, where q is the number of items produced. If the fixed costs are $5000 and the items are sold for $600 each, what is the break even point?

11. Use the following figure to estimate $\int_0^8 f(x)\,dx$ (average left- and right-hand sums).
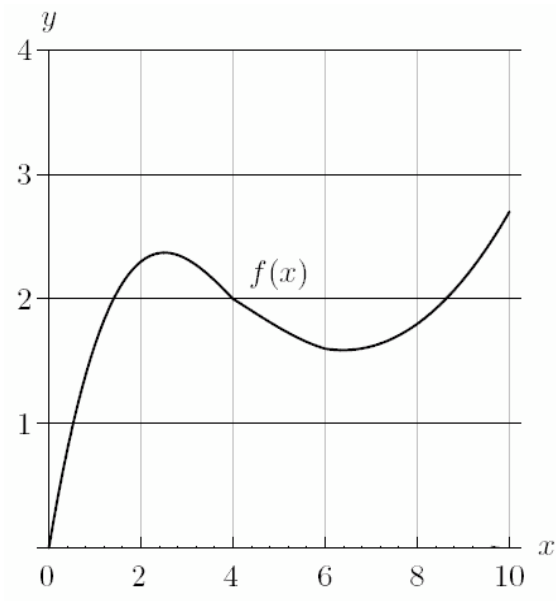
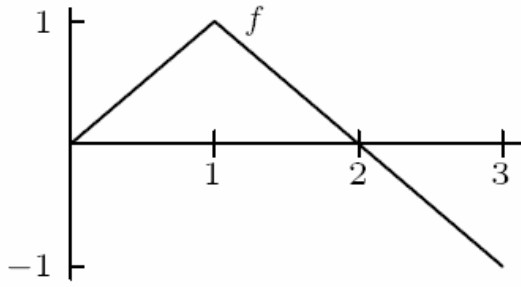12. The graph below shows a marginal cost function, $C'(q)$ $ per item. If the fixed cost is $600, estimate the total cost of producing 250 items.
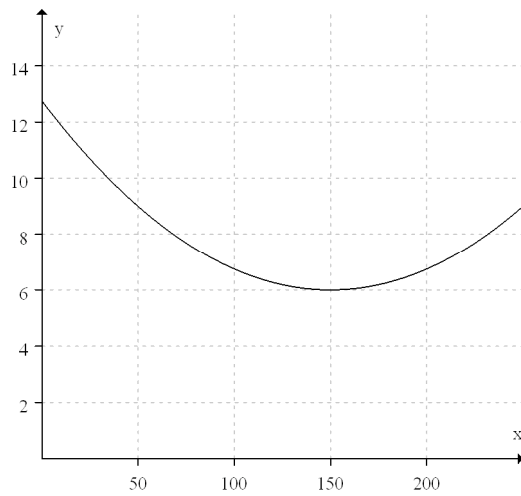
A) $ 2550
B) $ 1650
C) $1530
D) $2950

13. The graph of f is shown in the following figure. Find $F(3)$ if $F' = f$ and $F(0) = 2$.


14. The table below gives the average rate of monthly U.S. field production of crude oil for each decade from the 1920s through the 2000s (based on estimates calculated from the US Energy Information Administration). Use this data to estimate the total US field production from the 1960s to the 2000s. Note that there are 120 months in a decade. Production is given in millions of barrels per month.

Decade	1920s	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s
Production	57	97	136	216	260	280	248	215	174

A) 115,260,000,000 barrels
B) 94,050,000,000 barrels
C) 221,352,000,000 barrels
D) 72,350,000,000 barrels

15. The rate of growth of the net worth of a company is given by $2000 - 12t^2$ dollars per year t years after its formation in 1990. How much did it increase in value between 1990 and 2005?

16. Equal numbers of two different species of ground squirrels are introduced into an area at time $t = 0$, with t in years. They have the growth rates shown in the following figure. Which species had a larger population after 2 years?

additional squirrels per year

Species A

Species B

1   2   3   (years)
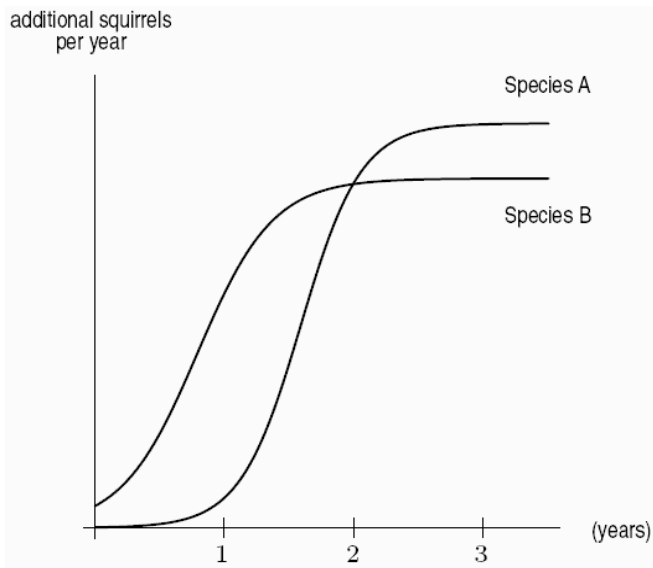
A) Species B
B) Species A

17. Estimate the area above the curve $y = \cos x$ and below $y = 1$ for $0 \le x \le \pi/2$. Round to 2 decimal places.

18. Suppose $F(x) = 3\sin x + x + 4$. Find the total area bounded by $F(x)$, $x = 0$, $x = \pi$, and $y = 0$. Round to 1 decimal place.

19. A large ice cube is melting at a rate of $r = f(t)$ cm^3 per minute, where t is time in minutes. If V_0 is the volume of the ice cube at time $t = 0$ minutes, which one of the following expresses the volume of the ice cube after 4 hours?
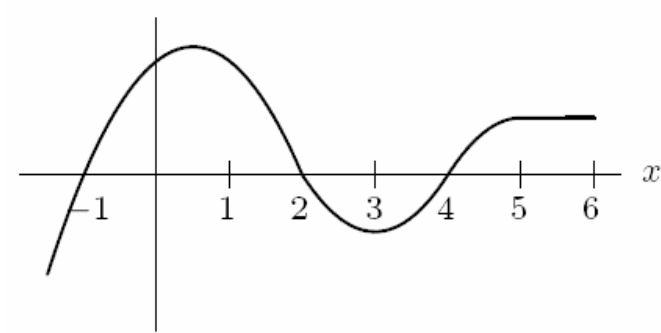
A) $V_0 - \int_0^4 f(t)dt$

B) $V_0 - \int_0^{240} f(t)dt$

C) $V_0 \int_0^{240} f(t)dt$

D) $V_0 + \int_0^4 f(t)dt$

20. The graph of f'' is shown below. If f is increasing at $x = -1$, which of the following <u>must</u> be true? Choose all that apply.


A) $f'(2) = f'(4)$
B) $f'(4) > f'(-1)$
C) $f'(4) > 0$
D) $f(5) = f(6)$

21. The following table gives the rate, in cubic centimeters, that air is leaking from a balloon t seconds after it is inflated. Let $r(t)$ be that rate. What is the meaning of $\int_0^{15} r(t)\, dt$?

t	0	5	10	15	20
$r(t)$	14	11	9	8	7

A) The rate in cubic centimeters per second that air is leaking out of the balloon after 15 seconds.
B) The total number of cubic centimeters of air that have leaked out of the balloon after 15 seconds.
C) The number of seconds it takes for 15 cubic centimeters of air to leak out of the balloon.
D) The number of seconds it takes for the rate air is leaking out of the balloon to be 15 cubic centimeters per minute.

22. Which of the following is the best approximation for $\int_0^{20} f(x)\, dx$, where f is shown in the following figure?
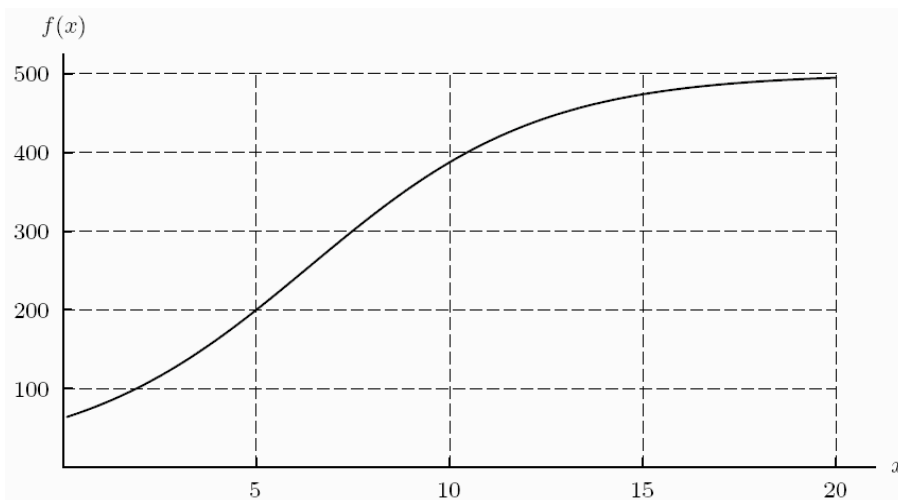
A) 300
B) 1000
C) 4500
D) 6575

23. A. Find a 4-term left Riemann sum approximation for the integral $\int_{30}^{34} 3\sqrt{x+1}\ dx$. Round to 1 decimal place.

   B. Is your answer in part (A) an underestimate or an overestimate?

24. You plan to approximate the definite integral $\int_{5}^{10} -(4x+3)^2\ dx$ by Riemann sums. Which Riemann sum will be larger, the right or the left?

25. Use a calculator to evaluate $\int_{-1}^{1} \ln(t^2+1)dt$. Round your answer to 2 decimal places.

Answer Key - Chap5

1. 330
2. 21
3. 10
4. −3.5
5. 72
6. A
7. B
8. D
9. C
10. 50
11. 13.5
12. A
13. 2.5
14. A
15. $16,500
16. A
17. 0.57
18. 23.5
19. B
20. B, C
21. B
22. D
23A. 68.4
23B. underestimate
24. left
25. 0.53