Review - Integration/Particle Motion

Evaluate the indefinite integral.

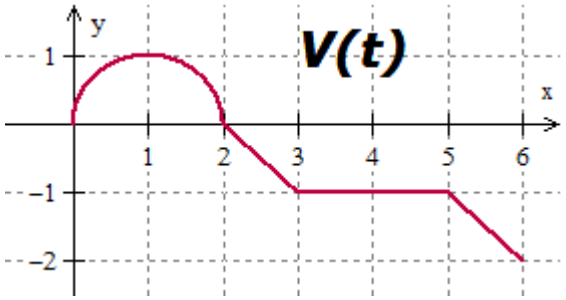
1. $\int x\sqrt{x+2}\,dx$
2. $\int 6a^4\left(2a^5-1\right)^3 da$
3. $\int\left(3x^2-x\right)^4(12x-2)dx$
4. $\int 3x\sqrt[3]{1-x^2}\,dx$
5. $\int\frac{2x^2}{\sqrt{1+x^3}}dx$
6. $\int\tan^4 x\sec^2 x\,dx$
7. $\int\frac{\sin x}{\cos^3 x}dx$
8. $\int\left(x^2+1\right)\left(x^3+3x\right)^4 dx$
9. $\int\frac{\sin\sqrt{x}}{\sqrt{x}}dx$

Evaluate the definite integral.

10. $\int_0^2 5x\left(3x^2-1\right)^3 dx$
11. $\int_1^4\frac{x}{\sqrt{x}}dx$
12. $\int_3^5\frac{2x}{\sqrt{2x-6}}dx$
13. $\int_1^2 x\sqrt{x-1}\,dx$
14. $\int_0^1 y\left(y^2+1\right)^5 dy$

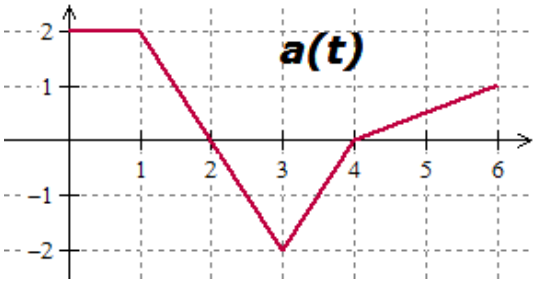
Particle Motion

15. The velocity of the particle traveling on the x-axis over a 6 second time interval is shown at the right.
The position at time t = 0 is 1.



   a. Name the particles acceleration at
      t = 1 t = 2.567
   b. What is the particle's position at
      t = 2 t = 6
   c. Is the speed of the particle increasing or decreasing at t = 5.5? Explain!
   d. What is the particle's minimum position? When does it occur?
   e. What is the average acceleration from t = 0 to t = 6?
   f. Name the particle's average velocity from t = 0 to t = 6?

16. The acceleration of a particle traveling on the x-axis over a 6 second time interval is shown at the right. The velocity is -2 at t = 0.



   a. What is the velocity at
      t = 1 t = 6
   b. Is the speed of the particle increasing or decreasing at t = 5? Explain!
   c. What is the particle's minimum velocity? When does it occur?
   d. What is the average acceleration from t = 0 to t = 6?

17. A particle moves along the x – axis in such a way that the acceleration at time t for t > 0 is given by $a(t)=2t$. When t = 1, the position of the particle is 2 and the velocity is 5.
   a. Write an equation for the velocity, v(t), of the particle for all t > 0.
   b. Write an equation of the position, x(t) of the particle for all t > 0.
   c. Find the velocity when the acceleration is 3.
   d. Find the average acceleration from t = 0 to t = 2.

18. Name 2 ways that you **COULD** find the average velocity. Show the correct equations but **do not solve**.

CALCULATOR – Show the calculation that leads to your answer!

A velocity of a particle as it moves along the x-axis is described by $v(t)=3\sin(0.5x^2+1.6)$ from t = 0 seconds to t = 3 seconds. The starting position of the particle is 2.

a. When is the particle moving right?

b. Find the particle's acceleration at t=2.

c. Is the particle speeding up or slowing down at t = 2. EXPLAIN.

d. When is the particle at rest?

e. What is the total distance that the particle covers in the 3 seconds?

f. What is the average velocity of the particle during the 3 seconds?

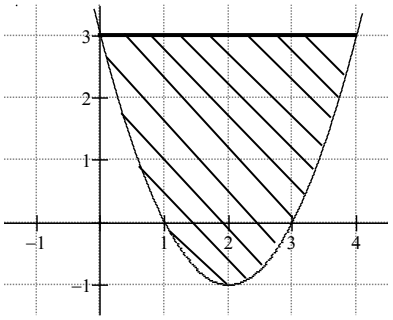
g. What is the average acceleration of the particle over the 3 seconds?

h. What is the particle's position at t = 3?

i. Draw a labeled picture of the particle's movement in the box. Show the calculations.

j. What is the closest distance that the particle gets to x = 8? When is it there?

19. Find the area of the striped region for $f(x)=x^2-4x+3$ pictured.



20-21 Find the area that is between function and the x – axis and the curve on the given interval without a calculator. You may check your answer with a calculator.

20. $f(x)=x^2+2x$, [-3,0]

21. $g(x)=\sin x$, $[0,2\pi]$

22. Find k such that $\int_1^k 3x^2+2x\ dx=-2$

Answers Review - Particle Motion

1. $\frac{2}{15}(x+2)^{\frac{3}{2}}(3x-4)+c$
2. $\frac{3}{20}(2a^5-1)^4+c$
3. $\frac{2}{5}(3x^2-x)^5+c$
4. $-\frac{9}{8}(1-x^2)^{\frac{4}{3}}+c$
5. $\frac{4}{3}\sqrt{x^3+1}+c$
6. $\frac{1}{5}\tan^5 x+c$
7. $\frac{1}{2}\sec^2 x+c$
8. $\frac{1}{15}(x^3+3x)^5+c$
9. $-2\cos\sqrt{x}+c$
10. 3050
11. 14/3
12. 44/3
13. 16/15
14. 21/4
15. –
    a. 0, -1
    b. $1+\frac{\pi}{2}$, $-3+\frac{\pi}{2}$
    c. Vel neg, acc neg; speed increasing
    d. $-3+\frac{\pi}{2}$ at t = 6
    e. -1/3
    f. $\frac{\pi}{12}-\frac{2}{3}$
16. –
    a. 0, 0
    b. VEL NEG, ACC POS; SPEED IS DECREASING
    c. MIN VELOCITY AT t = 0 and vel is -2
    d. 1/3
17. –
    a. $v=t^2+4$
    b. $pos=\frac{1}{3}t^3+4t-\frac{7}{3}$
    c. At t =3/2, vel is 25/4
    d. 2
    e. $\frac{1}{b-a}\int_a^b v(t)dt$ OR $\frac{P(b)-P(a)}{b-a}$
18. -
    a. (0,1.756)
    b. -5.381
    c. NEG VEL, NEG ACC; SPEEDING UP
    d. 1.756
    e. 6.513
    f. 0.547
    g. -1.182
    h. 3.642
    i. –
    j. At t = 1.756 the particle is 1.922 away from x = 8
19. 32/3
20. 8/3
21. 4
22. -1, 0