



## Applications of Integrals

*Integrals are powerful tools for solving problems.*

7A

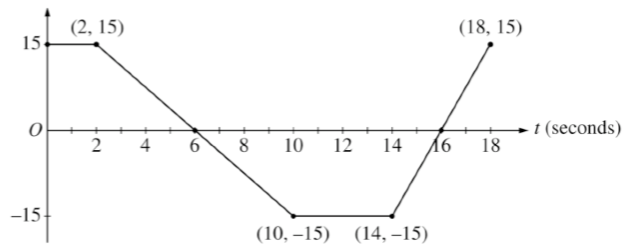
### Understanding Integrals as Net Change

1. Explain the difference between displacement and distance traveled
2. Calculate net change in a variety of situations

*[7.1] 1 - 7 odd, 11, 17, 19, 23*

**Explain the difference between displacement and distance traveled**

Sample Question



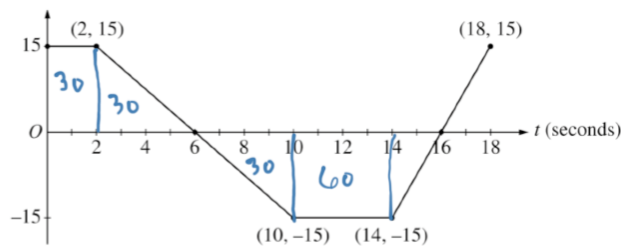
A particle is moving along the x-axis with a velocity shown in the graph above for  $t$  seconds where  $0 < t < 18$ .

What is the total distance traveled by the particle in the first 10 seconds?

If the particle was at  $x=4$  when  $t=0$ , where is the particle after 14 seconds?

Sample Response

[Show / Hide Answer](#)



A particle is moving along the x-axis with a velocity shown in the graph above for  $t$  seconds where  $0 < t < 18$ .

What is the total distance traveled by the particle in the first 10 seconds?

90 UNITS TRAVELLED IN 10 SECONDS

If the particle was at  $x=4$  when  $t=0$ , where is the particle after 14 seconds?

$x = -20$  BECAUSE

ON  $(0, 6)$  IT MOVES RIGHT 60 UNITS

ON  $(6, 14)$  IT (THE PARTICLE) MOVES LEFT

90 UNITS... SO NET CHANGE OF

$-30$

$-30 + 4 = -26 \therefore x = -26$

Calculate net change in a variety of situations

<p>Sample Question</p>	<p>Recall that the acceleration due to Earth's gravity is <math>32 \text{ ft/sec}^2</math>. From ground level, a projectile is fired straight upward with velocity <math>90 \text{ ft/sec}</math>.</p> <p>a) What is its velocity after 3 seconds?</p> <p>b) When does it hit the ground?</p> <p>c) When it hits the ground, what is the net distance it has traveled?</p> <p>d) When it hits the ground, what is the total distance it has traveled?</p>
<p>Sample Response</p>	<p style="text-align: center;"><a href="#">Show / Hide Answer</a></p> <p>Recall that the acceleration due to Earth's gravity is <math>32 \text{ ft/sec}^2</math>. From ground level, a projectile is fired straight upward with velocity <math>90 \text{ ft/sec}</math>.</p> <p>a) What is its velocity after 3 seconds?</p> <p>b) When does it hit the ground?</p> <p>c) When it hits the ground, what is the net distance it has traveled?</p> <p>d) When it hits the ground, what is the total distance it has traveled?</p> <p><math>v(t) = 90 - 32t</math></p> <p>a) <math>v(3) = 90 - 32(3) = -6 \text{ ft/sec}</math></p> <p>b) <math>v(t) = 0</math> is max HEIGHT</p> $90 - 32t = 0$ $\frac{-90}{-32} = t, \text{ max HEIGHT AT } t = 2.8125$ <p style="margin-left: 100px;">SO HITS GROUND AT 5.625 SEC</p> <p>c) <math>\int_0^{5.625} v(t) dt = 0</math></p> <p>d) <math>2 \int_0^{2.8125} v(t) dt = 253.125 \text{ ft}</math></p> <p style="margin-left: 100px;">OR <math>\int_0^{5.625}  v(t)  dt = 253.125 \text{ ft}</math></p>