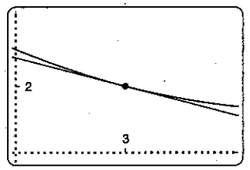
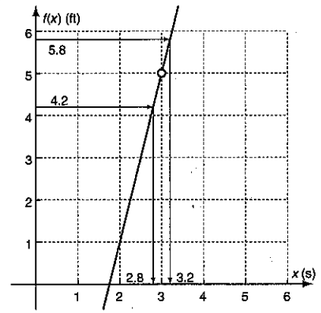


C3. a. $f(x) = \dfrac{4x^2 - 19x + 21}{x - 3} = \dfrac{(4x - 7)(x - 3)}{x - 3} =$
$4x - 7,\ x \neq 3$
When $x = 3$, $4x - 7 = 4 \cdot 3 - 7 = 5$.

b.



c. $5.8 = 4(3 + \delta) - 7$
$5.8 = 12 + 4\delta - 7$
$4\delta = 0.8$
$\delta = 0.2$

$4.2 = 4(3 - \delta) - 7$
$4.2 = 12 - 4\delta - 7$
$-4\delta = -0.8$
$\delta = 0.2$

d. $4(3 + \delta) - 7 = 5 + \varepsilon$
$12 + 4\delta - 7 = 5 + \varepsilon$
$4\delta = \varepsilon$
$\delta = \frac{1}{4}\varepsilon$

There is a positive value of δ, namely $\frac{1}{4}\varepsilon$, for each positive value of ε, no matter how small ε is.

e. $L = 5$, $c = 3$. ". . . but not equal to 3" is needed so that you can cancel the $(x - 3)$ factors without dividing by zero.

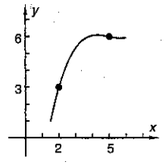
Chapter Test

T1. Limit, derivative, definite integral, indefinite integral

T2. See the text for the definition of *limit*.

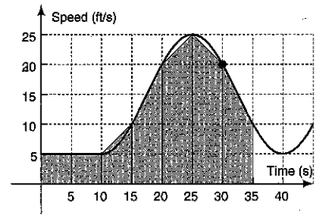
T3. Physical meaning: instantaneous rate

T4.



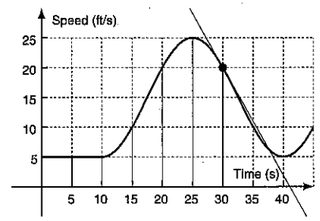
T5. Concept: definite integral
By counting squares, distance ≈ 466.
(Exact answer is 466.3496… .)

T6.



$T_7 = 5(2.5 + 5 + 5 + 10 + 20 + 25 + 20 + 5) = 462.5$
Trapezoidal rule probably underestimates the integral, but some trapezoids are inscribed and some circumscribed.

T7. Concept: derivative



Slope ≈ −1.8 (ft/s)/s
(Exact answer is −1.8137… .)
Name: acceleration

T8. The roller coaster is at the bottom of the hill at 25 s because that's where it is going the fastest. The graph is horizontal between 0 and 10 seconds because the velocity stays constant, 5 ft/s, as the roller coaster climbs the ramp.

T9. Distance = (rate)(time) = 5(10) = 50 ft

T10. $T_5 = 412.5$; $T_{50} = 416.3118\ldots$;
$T_{100} = 416.340219\ldots$

T11. The differences between the trapezoidal sum and the exact sum are:
For T_5: difference = 3.8496…
For T_{50}: difference = 0.03779…
For T_{100}: difference = 0.009447…
The differences are getting smaller, so T_n is getting closer to 416.349667… .

T12. From 30 to 31:

$$\text{average rate} = \frac{y(31) - y(30)}{1} = -1.9098\ldots$$

From 30 to 30.1:

$$\text{average rate} = \frac{y(30.1) - y(30)}{0.1} = -1.8246\ldots$$

From 30 to 30.01:

$$\text{average rate} = \frac{y(30.01) - y(30)}{0.01} = -1.8148\ldots$$

T13. The rates are negative because the roller coaster is slowing down.

T14. The differences between the average rates and instantaneous rate are:
For 30 to 31: difference = 0.096030…
For 30 to 31.1: difference = 0.010833…
For 30 to 30.01: difference = 0.001095…
The differences are getting smaller, so the average rates are getting closer to the instantaneous rate.

T15. Solve $\frac{y(x) - y(30)}{x - 30} = -1.81379936 + 1$, getting $x = 30.092220\ldots$. So keep x within 0.092… unit of 30, on the positive side.

T16. Concept: derivative

T17. $f'(4) \approx \frac{f(4.3) - f(3.7)}{4.3 - 3.7} = \frac{35 - 29}{0.6} = 10$

T18. Answers will vary.

$\frac{31-29}{3} = 6.\overline{6} > 2$

$\frac{35-31}{3} = 13.\overline{3}$ $= 9$