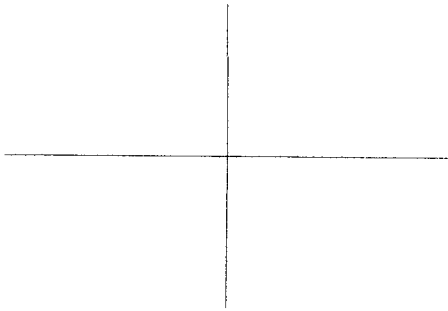


Do any 12 of the following 13 problems. *Show all work.*

1. (a) Find an equation of the line through the points $(1, -2)$, $(5, 8)$.

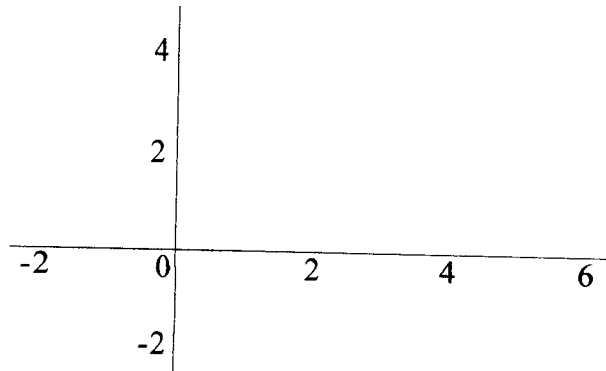
(b) Find the slope and y -intercept of the line $5x + 2y = 10$, and graph the line.



2. The functions $P(t) = 1000(1.04)^t$ and $Q(t) = 1400(0.93)^t$ give the population of towns A and B , respectively, in t years.
- (a) In each case, state whether the population is increasing or decreasing, and give the corresponding rate of change.
 - (b) In approximately how many years will the populations of the two towns be equal?

3. A cup of coffee contains 120 mg of caffeine, and the amount A of coffee t hours after drinking a full cup is given by the formula $A = 120e^{-0.15t}$.
- How much caffeine is in the body in 2.5 hours?
 - What is the half-life of caffeine in the body?
4. In t seconds, a particle moves S meters in a straight line, where $S = 5t^2$.
- Find the average velocity $\frac{S(3+h) - S(3)}{h}$ between $t = 3$ and $t = 3+h$, ($h \neq 0$).
 - Use part (a) to find the average velocity between $t = 3$ and $t = 3.01$.
 - Use part (a) to find the instantaneous velocity at $t = 3$.
5. Given $f(x) = x^2 + 3x + 5$, use the definition $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ to find $f'(x)$.

6. Sketch the graph of a function on the interval $[-2, 6]$ with the following properties.
- (a) $f(-2) = -2$, $f(2) = 2$, $f(6) = 4$
 - (b) $f'(x) > 0$ for all x in $(-2, 6)$
 - (c) $f''(x) < 0$ for $-2 < x < 2$, $f''(x) > 0$ for $2 < x < 6$



In problems 7 and 8, use the rules for differentiation to find the derivative of each of the given functions.

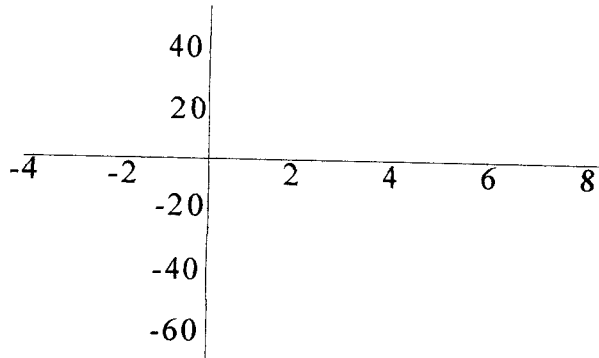
7. (a) $f(x) = \frac{1}{x} + e^{x^2+1}$

(b) $g(x) = \sin 2x + \cos 2x$

8. (a) $f(x) = x^2 \ln x$

(b) $g(x) = \frac{2x-3}{4x+5}$

9. (a) Find the critical points and inflection points for $f(x) = x^3 - 3x^2 - 24x + 16$, and use this information to graph $y = f(x)$ on the interval $[-4, 7]$.
 (b) Find the global maximum and minimum values for $f(x)$ on the interval $[-4, 7]$.

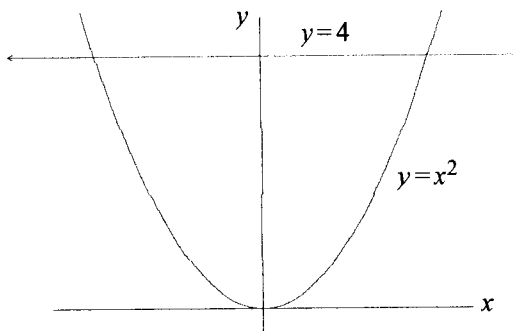


10. A car is moving with decreasing velocity, and its velocity is recorded every 5 seconds as indicated in the table.

Time (sec)	0	5	10	15	20	25	30
Velocity (ft/sec)	50	45	40	30	25	15	10

- (a) Based on the data in the table, give a lower estimate L and an upper estimate U for the total distance traveled.
 (b) Illustrate your result in part (a) graphically.

11. Find the area of the region between the curves $y = 4$ and $y = x^2$ shown below.



12. (a) Find the average value f_{avg} of the function $f(x) = 15 - x^2$ on the interval $[0, 3]$.
(b) Find a value for x in the interval $[0, 3]$ for which $f(x) = f_{\text{avg}}$.
(c) Use part (b) to construct a rectangle on $[0, 3]$ whose area equals $\int_0^3 f(x) dx$.

13. Use the method of substitution to evaluate each of the following integrals.

(a) $\int_1^4 2x\sqrt{x^2 + 9} dx$ (b) $\int_0^1 \frac{e^x}{1 + e^x} dx$