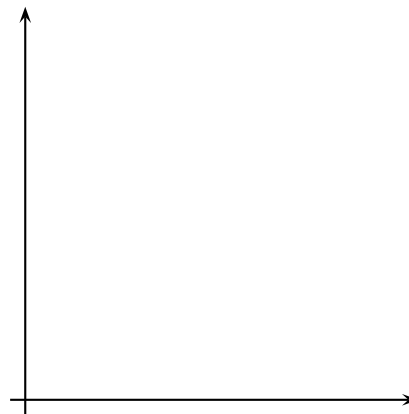


1. You leave home and drive toward the mall which is about 10 miles away. When you are about halfway there, you have a flat tire. It takes a while to get the tire changed, after which you return home to clean up. Then you drive to the mall uneventfully.

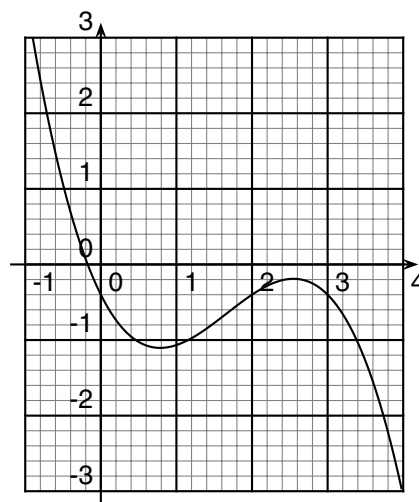
Let $d(t)$ denote the distance you are from your home at time t . Sketch a graph of $d(t)$ that reflects the given information. (9 points)



2. How much money should you deposit now in an account so that 10 years of continuously compounded interest at 6% per year you will have a total of \$10,000? (8 points)

3. If the world population increases at a rate of 2% per year, how long will it take to double? (You may use the “rule of 70” for an approximate value; be more accurate if you like.) (6 points)

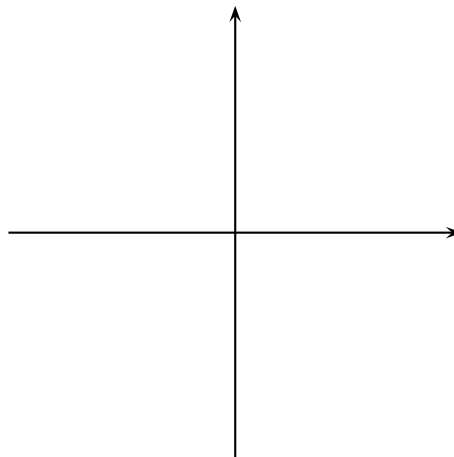
4. A function $f(x)$ is shown. Sketch a graph of $f'(x)$ on the same set of axes. Indicate the local extrema (maxes and mins) and inflection points on the graph of f if there are any. (9 points)



5. A mutual fund currently has a net asset value of \$80 per share. Its value per share has been increasing recently at a rate of \$0.55 per day. Let $f(t)$ denote the value per share t days from now. Express the information given in this problem in terms of f and f' . Then assume the growth rate remains constant and estimate $f(12)$. (9 points)

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6. Sketch a graph of a continuous function f with the the following properties: (9 points)

- (a) $f'(x) < 0$ on $[-3, -1]$ and on $[2, 3]$
- (b) $f'(x) > 0$ on $[-1, 2]$
- (c) $f''(x) > 0$ on $[-2, 0]$
- (d) $f''(x) < 0$ on $[-3, -2]$ and on $[0, 3]$
- (e) $f(0) = 2$



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7. Let $f(t)$ denote the value of a stock at time t . Explain in terms of the signs of f' and f'' what it means if “the value of the stock price has been rising lately but is beginning to level off.” (8 points)

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8. Let $MC(q)$ and $MR(q)$ denote the marginal cost and marginal revenue functions, respectively, where q is the quantity of items produced. If $C(100) > R(100)$ and $MC(100) > MR(100)$, would you recommend increasing q or decreasing q in an effort to move toward profitability? Explain. (8 points)

9. Find an equation of the tangent line to the graph of $y = x^3 - 3x^2 + 1$ when $x = 1$. (8 points)

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10. Find the derivative of the following functions. (6 points each)

(a) $f(x) = e^{x^2+1}$

(b) $f(x) = (x^2 + 3x - 10)^8$

(c) $f(x) = x^2 e^x$

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11. Let $f(x) = x^4 - 8x^3 + 16x^2 + 101$. Show that f has a critical point at $x = 2$. Then apply the second derivative test to the critical point (show the details). What do you conclude? Explain. (8 points)