1. Consider the graphs of the functions \( f(x) = x - 1 \) and \( g(x) = x - 4 \) as given in the sketch below. We will study the product of the two functions \((fg)\).

a. Fill in the values in the table:

<table>
<thead>
<tr>
<th>( x )</th>
<th>-4</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( g(x) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>((fg)(x))</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. Compute the product function algebraically.

c. The graph below shows the functions together with the product. Explain the properties of the graph of the product from the properties of the factor functions, e.g. where is the product positive, negative, zero?
2. Read the derivation below the heading "Using the Quadratic Formula" on page 182. Explain in your own words how the formula from the quadratic formula is derived by solving the equation \( ax^2 + bx + c = 0 \) by completing the square.

3. Simplify: a. \((x + i)(x - i)\). b. \((x-(3+2i))(x-(3-2i))\).

4. Use the results from problem 3 to explain that a quadratic function with complex zeros can have real coefficients, as long as the zeros are complex conjugates.

5. Use the method of substitution from Example 5 in section 2.3 to solve the equation \( x^4 + x^2 - 6 = 0 \).

6. In Example 4 in section 2.3 you solved \( x^2 + 5x + 8 = 0 \) and found the solutions \( x = -\frac{5}{2} - \frac{\sqrt{7}}{2}i \) and \( x = -\frac{5}{2} + \frac{\sqrt{7}}{2}i \).

   Use these results to express \( x^2 + 5x + 8 \) as a product of linear factors. Note that the factors don't have only real coefficients.

7. Find the equation of a quadratic function, which has its vertex at \((1,1)\) and goes through the point \((3, 0)\).

8. Solve the equation \( y = x^2 - 8x -12 \) by completing the square.

9. Solve the equation \( y = 2x^2 - 6x -9 \) by completing the square.

10. Look over Example 7 in section 2.3 on page 186. Find the speeds of both bikers if Castulo bikes 6 km/h slower than Linette.

11. Look over Example 5 in section 2.4 on page 196. What is the maximum area if the stonemason has enough stones for 80 ft of stonewall?

12. Look over Example 6 in section 2.4 on page 198. How long would it have taken for the sound of the splash to be heard if the top of well was 120 feet from the water level?
13. Look over Example 1 in section 2.5 on page 203. Redo the problem if the data was given as in the table below:

<table>
<thead>
<tr>
<th>Year, x</th>
<th>1973, 0</th>
<th>1980, 7</th>
<th>1987, 14</th>
<th>1993, 20</th>
<th>1997, 24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leisure hours per week</td>
<td>28</td>
<td>18</td>
<td>16</td>
<td>19</td>
<td>20</td>
</tr>
</tbody>
</table>

You may want to check out the graphing calculator manual to see how this is done on your calculator model.

14. Express the vertical distance $d$ of a point $(x,y)$ on the parabola $y = x^2$ from the line $y = 3x + 2$ as a function of $x$.

15. Express the height $h$ of an isosceles right triangle as a function of the length $s$ of one of its legs. (You can assume that the hypotenuse is the base of the triangle and that the height $h$ divides the hypotenuse into two equal segments.)

16. Find the $y$ intercept $b$ of a line through the point $(1,2)$ as a function of its $x$ intercept $a$. (Hint: Make a sketch, label all lengths, and identify similar triangles.)

17. Express the surface area $A$ of a cube as a function of the length of its side $a$.

18. A plane leaves City A at the same time a second plane leaves City B. Both planes travel at 300 mph and are headed for each other's city. Assume that City A is 1000 miles apart from City B. Express the distance $d$ of the planes from each other as a function of the time $t$ measured in hours after takeoff.

19. Shirley Thrifty wishes to know how her friend invested $4800. Part of the money was invested at 12% and the rest at 8%. In the first year, the total yield in simple interest was the same as if the whole amount had been invested at 9%.

20. Sarah’s salary in 1999 was $46,895.44. This represents a 0.8% increase over the 1998 salary. What was the 1998 salary?