1. (a) \(16\) points A ball is thrown upwards from a height of 20 ft with an initial velocity 32 ft/sec. The height of the ball after \(t\) seconds is given by

\[ h(t) = -16t^2 + 32t + 20. \]

(i) Find the maximum height the ball will reach, and the time it reaches the maximum height.

(ii) Find the time when the ball hits the ground.

(b) \(5\) points Solve the following inequality:

\[ \left| \frac{1}{3}x - 3 \right| < \frac{3}{2} \]
2. (a) (12 points) Let \( f(x) = 3x^2 + 12x + 10 \). Determine if \( f \) has an absolute maximum or minimum and find it. Find the vertex and axis of symmetry of the graph \( y = f(x) \). Use this information to sketch the graph.

(b) (8 points) Complete the square and write the function \( f(x) = 2x^2 - 6x + 5 \) in the form \( f(x) = a(x - h)^2 + k \).
3. (a) (10 points)
   (i) The radioactive element carbon-14 has half life of 5750 years. Find its exponential decay rate.
   (ii) A mummy discovered in a pyramid in Egypt has lost 45% of its carbon-14. Determine its age.

(b) (10 points) If \( \ln a = 3, \ln b = 4, \ln c = -5 \), evaluate the following expressions.
   (a) \( \ln \frac{b^3}{c^2} \)  
   (b) \( \ln \sqrt{abc} \)
4. (21 points) Solve the following equations.
   (a) \(3^{4x+5} = 9\)

   (b) \(3^{x+2} = 4^{3x}\)

   (c) \(\log_3(5 + 2x) = 2\)
5. (18 points) Match the functions with their graphs.

<table>
<thead>
<tr>
<th></th>
<th>Function</th>
<th>Graph:</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>$y = x^2 - 3x - 3$</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>$y = 4^x - 5$</td>
<td></td>
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<tr>
<td>3</td>
<td>$y = \log_2(4x + 8)$</td>
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</tr>
<tr>
<td>4</td>
<td>$y = 5x - x^2 - 4$</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>$y = 3 - 4^x$</td>
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</tr>
<tr>
<td>6</td>
<td>$y = \ln(x + 4) - 1$</td>
<td></td>
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