1. Use the discriminant to determine the number of real roots for the following quadratic equations. Be sure to show your working out when necessary.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Value of Discriminant</th>
<th>Number &amp; Type Roots</th>
<th>Justify</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2x^2 + 6x - 12 = 0$</td>
<td>$(6)^2 - 4(2)(-12)$</td>
<td>$36 + 96 = 132$</td>
<td>$70$</td>
</tr>
<tr>
<td>$4x^2 + 11x + 1 = 0$</td>
<td>$(11)^2 - 4(4)(1)$</td>
<td>$121 - 16 = 105$</td>
<td>$70$</td>
</tr>
<tr>
<td>$x^2 = -4x - 4$</td>
<td>$(4)^2 + 4(1)(4)$</td>
<td>$16 - 16 = 0$</td>
<td>$0$</td>
</tr>
<tr>
<td>$5x^2 - 2x = -25$</td>
<td>$(-2)^2 - 4(5)(-25)$</td>
<td>$4 - 500 = -496$</td>
<td>$0$</td>
</tr>
<tr>
<td>$(2x - 5)(2x + 5) = 0$</td>
<td>$101^2 - 4(4)(-25)$</td>
<td>$0 + 400 = 400$</td>
<td>$0$</td>
</tr>
<tr>
<td>$(3x + 2)^2 = 0$</td>
<td>$(12)^2 - 4(9)(4)$</td>
<td>$144 - 144 = 0$</td>
<td>$0$</td>
</tr>
</tbody>
</table>

2. Write each of the following in standard form and then find the axis of symmetry.

a) $y = (2x + 3)^2$

$y = 4x^2 + 12x + 9$

$x = \frac{-b}{2a} = \frac{-12}{2(4)} = -\frac{3}{2}$

AOS: $x = -\frac{3}{2}$

b) $f(x) = (4x + 7)(4x - 7)$

$f(x) = 16x^2 - 49$

$x = \frac{0}{2(16)} = 0$

AOS: $x = 0$

c) $v(t) = 4(3t + 2)(t - 3)$

$v(t) = 4(3t^2 - 7t - 6)$

$v(t) = 12t^2 - 28t - 24$

$x = \frac{28}{2(12)} = \frac{7}{6}$

AOS: $x = \frac{7}{6}$

3. Write each of the following quadratic functions in intercept form. Be sure to look for a GCF first.

a) $f(x) = 9x^2 - 13x - 10$

$f(x) = x^2 - \frac{13}{9}x - \frac{10}{9}$

$f(x) = (x - \frac{13}{2})(x + \frac{5}{2})$

$f(x) = (x - 2)(9x + 5)$

b) $s(t) = 18t^2 + 36t + 16$

$s(t) = 2(t^2 + 2t + 8)$

$s(t) = 2(t^2 + 18t + 72)$

$s(t) = 2(t + 2)(t + 6)$

c) $y = 3x^2 - 27$

$y = 3(x - 3)(x + 3)$

$y = 2(t + \frac{9}{2})(t + \frac{2}{3})$

$y = 2(3t + y)(3t + 2)$
4. Use the graphs shown below to answer each of the questions.

**Comparison Set #1:**
Which two quadratic equations appear to have two real roots? **A, F**

What must be true about the value of the discriminant? \[ b^2 - 4ac > 0 \]

**Comparison Set #2:**
Which two quadratic equations appear to have one real root? **B, D**

What must be true about the value of the discriminant? \[ b^2 - 4ac = 0 \]

**Comparison Set #3:**
Which two quadratic equations appear to have no real roots? **E, C**

What must be true about the value of the discriminant? \[ b^2 - 4ac < 0 \]

5. Given each of the following equations, write each in intercept form then find the solutions.

a) \[ y = 16x^2 - 1 \]

\[ y = (4x+1)(4x-1) \]
\[ 0 = (4x+1)(4x-1) \]
\[ 4x+1 = 0 \quad 4x-1 = 0 \]
\[ x = -\frac{1}{4} \quad x = \frac{1}{4} \]
\[ \text{int form: } y = (4x+1)(4x-1) \]

b) \[ 6x^2 + 27x = 15 \]

\[ 3(2x^2 + 9x - 5) = 0 \]
\[ 3(x^2 + 3x - \frac{5}{2}) = 0 \]
\[ 3 \left( x + \frac{3}{2} \right) \left( x - \frac{1}{2} \right) = 0 \]
\[ x = -\frac{3}{2}, \quad x = \frac{1}{2} \]

f: \[ f(x) = 4(x - 3)(3x+2) \]
\[ x-3=0 \quad 3x+2=0 \]
\[ x=3 \quad x=-\frac{2}{3} \]
\[ (3,0), \left(-\frac{2}{3}, 0 \right) \]

\[ f(x) = 4(x - 3)(3x+2) \]
\[ x-3=0 \quad 3x+2=0 \]
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\[ x=3 \quad x=-\frac{2}{3} \]
\[ (3,0), \left(-\frac{2}{3}, 0 \right) \]

\[ f(x) = 4(x - 3)(3x+2) \]
\[ x-3=0 \quad 3x+2=0 \]
\[ x=3 \quad x=-\frac{2}{3} \]
\[ (3,0), \left(-\frac{2}{3}, 0 \right) \]
6. Match each graph with its appropriate function.

A. \( a(x) = (x + 1)^2 - 1 \)
   \( \text{Vertex } (-1, -1) \) up

B. \( b(x) = -x^2 - 1 \)
   \( \text{Down} \)
   \( \text{Vertex } (0, -1) \)

C. \( c(x) = (x - 1)^2 + 1 \)
   \( \text{Up} \)
   \( \text{Vertex } (1, 1) \)

D. \( d(x) = x^2 - 2x + 1 \)
   \( = (x - 1)(x - 1) \)
   \( x = 1 \) Double root \( RT^+ \)

E. \( e(x) = x^2 + 2x + 1 \)
   \( = (x + 1)(x + 1) \)
   \( \text{Double root } x = -1 \)

F. \( f(x) = (x + 1)^2 + 1 \)
   \( \text{Up} \)
   \( \text{Vertex } (-1, 1) \)

G. \( g(x) = (x - 1)^2 - 1 \)
   \( \text{Up} \)
   \( \text{Vertex } (1, -1) \)

H. \( h(x) = x^2 - 1 \)
   \( \text{Up} \)
   \( \text{Vertex } (0, -1) \)