Eli Eshel-Krohn

1)  a)  $V^\pi(s) = R(s) + \gamma \sum_{s'} P(s' \mid s, \pi(s)) V^\pi(s')$

$V^\pi(0) = R(0) + \gamma \left( V^\pi(0)\frac{3}{4} + V^\pi(1)\frac{1}{4} \right)$

$V^\pi(0) = -2 + \frac{2}{3} \left( V^\pi(0)\frac{3}{4} + V^\pi(1)\frac{1}{4} \right)$

$V^\pi(0) = -2 + \frac{1}{2} V^\pi(0) + \frac{1}{6} V^\pi(1)$

$\frac{1}{2} V^\pi(0) = -2 + \frac{1}{6} V^\pi(1)$

$V^\pi(1) = R(1) + \gamma \left( V^\pi(1)\frac{3}{4} + V^\pi(0)\frac{1}{4} \right)$

$V^\pi(1) = 4 + \frac{2}{3} \left( V^\pi(1)\frac{3}{4} + V^\pi(0)\frac{1}{4} \right)$

$V^\pi(1) = 4 + \frac{1}{2} V^\pi(1) + \frac{1}{6} V^\pi(0)$

$\frac{1}{2} V^\pi(1) = 4 + \frac{1}{6} V^\pi(0)$

$\frac{1}{2} V^\pi(0) = -2 + \frac{1}{6} \left( 2\left( 4 + \frac{1}{6} V^\pi(0) \right) \right)$

$\frac{1}{2} V^\pi(0) = -2 + \frac{4}{3} + \frac{1}{18} V^\pi(0)$

$\frac{8}{18} V^\pi(0) = -\frac{2}{3}$

$\boxed{V^\pi(0) = -\frac{3}{2}}$

$\frac{1}{2} V^\pi(1) = 4 + \frac{1}{6} \left( 2\left( -2 + \frac{1}{6} V^\pi(1) \right) \right)$

$\frac{1}{2} V^\pi(1) = 4 - \frac{2}{3} + \frac{1}{18} V^\pi(1)$

$\frac{4}{9} V^\pi(1) = \frac{10}{3}$

$\boxed{V^\pi(1) = \frac{15}{2}}$

b) $P(0|0, a=1) V(0) + P(1|0, a=1) V(1)$

$\frac{1}{2} \cdot (-\frac{3}{2}) + \frac{1}{2} \cdot \frac{15}{2} = 3$

$\frac{3}{2}(V^{\pi}(0) + 2)$

$\frac{3}{2}(-\frac{3}{2} + 2) = \frac{3}{4}$

$\frac{3}{4} < 3$ so $\boxed{\pi'(0) = 1}$

$P(0|1, a=1) V(0) + P(1|1, a=1) V(1)$

$\frac{1}{2} \cdot (-\frac{3}{2}) + \frac{1}{2} \cdot \frac{15}{2} = 3$

$\frac{3}{2}(V^{\pi}(1) - 4)$

$\frac{3}{2}(\frac{15}{2} - 4) = \frac{21}{4}$

$21/4 > 3$ so $\boxed{\pi'(1) = 0}$