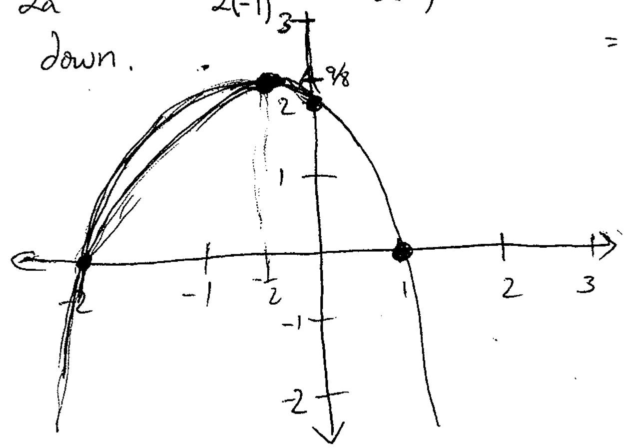
Name: Key

1. **[3 points]** Sketch the graph of the given function. Include all x and y intercepts.
$f(x) = -x^2 - x + 2 \;=\; -(x^2+x-2) \;=\; -(x+2)(x-1)$

- x-intercepts: $x=-2$, $x=1$
- y-intercept: $y=2$.
- $x_{vertex} = -\frac{b}{2a} = -\frac{(-1)}{2(-1)} = -\frac{1}{2}$, $y_{vertex} = -(-\frac{1}{2})^2 - (-\frac{1}{2}) + 2 = -\frac{1}{4} + \frac{1}{2} + 2 = 2 + \frac{1}{4} = \frac{9}{8}$
- Parabola opens down.



2. **[2 points]** Find the points of intersection (if any) of the given pair of curves.
$y = x^2 - x - 5$ and $y = x - 1$

$x^2 - x - 5 = y = x - 1$

$x^2 - x - 5 = x - 1$

$x^2 - 2x - 4 = 0$

- $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-4)}}{2(1)}$
$= \frac{2 \pm \sqrt{4+16}}{2}$
$= \frac{2 \pm \sqrt{20}}{2}$
$= \frac{2 \pm \sqrt{4 \cdot 5}}{2} = \frac{2 \pm 2\sqrt{5}}{2}$ **OVER →**
$= 1 \pm \sqrt{5}$

- So two intersections: $x_1 = 1 - \sqrt{5}$, $y_1 = x_1 - 1 = -\sqrt{5}$ | $x_2 = 1 + \sqrt{5}$, $y_2 = x_2 - 1 = \sqrt{5}$ | $\boxed{(1-\sqrt{5}, -\sqrt{5}) \text{ and } (1+\sqrt{5}, \sqrt{5})}$

3. Write an equation for the line with the given properties.

(a) [**2 points**] Through $(-2, 4)$ and $(5, -3)$.

- $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{-3-4}{5-(-2)} = \dfrac{-7}{7} = -1$

- $y - y_1 = m(x - x_1)$

$y - (4) = -1(x - (-2))$

$$\boxed{\begin{aligned} y - 4 &= -(x+2) \\ y &= -x + 2 \end{aligned}}$$

(b) [**3 points**] Through $(1, -2)$ and perpendicular to the line $3x - 4y = 4$.

- Rewrite $3x - 4y = 4$

$-4y = -3x + 4$

$y = \frac{3}{4}x - 1$

- $m_{line} = \frac{3}{4}$, $\quad m_{\perp} = -\dfrac{1}{m_{line}} = -4/3$

- $y - y_1 = m(x - x_1)$

$y - (-2) = -4/3(x - 1)$

$$\boxed{y + 2 = -4/3(x-1)}$$

$y = -4/3 x + \frac{4}{3} - 2$

$$\boxed{y = -4/3 x - \frac{2}{3}}$$