33 以下の二次関数のグラフを描き，軸と頂点を答えよ．

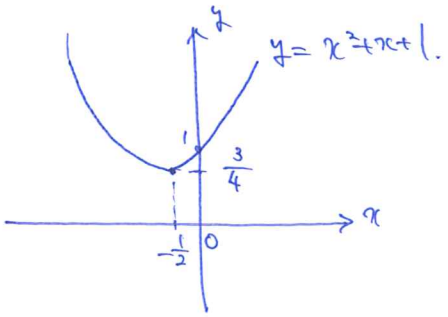
(1) $y = x^2 + x + 1$

$= \left(x+\frac{1}{2}\right)^2 - \frac{1}{4} + 1.$

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

軸 $x = -\frac{1}{2}$

頂点 $\left(-\frac{1}{2}, \frac{3}{4}\right)$.



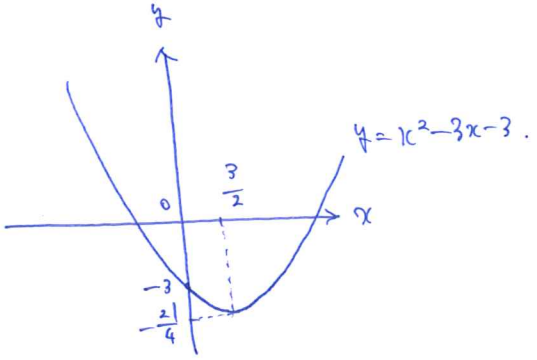
(2) $y = x^2 - 3x - 3$

$= \left(x-\frac{3}{2}\right)^2 - \frac{9}{4} - 3$

$= \left(x-\frac{3}{2}\right)^2 - \frac{21}{4}$

軸 $x = \frac{3}{2}$

頂点 $\left(\frac{3}{2}, -\frac{21}{4}\right)$



(3) $y = 2x^2 + 5x + 1$

$= 2\left(x^2 + \frac{5}{2}x\right) + 1$

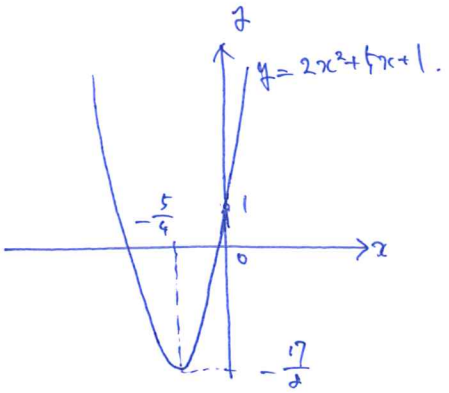
$= 2\left(\left(x+\frac{5}{4}\right)^2 - \frac{25}{16}\right) + 1$

$= 2\left(x+\frac{5}{4}\right)^2 - \frac{25}{8} + 1$

$= 2\left(x+\frac{5}{4}\right)^2 - \frac{17}{8}$

軸 $x = -\frac{5}{4}$

頂点 $\left(-\frac{5}{4}, -\frac{17}{8}\right)$



(4) $y = -3x^2 + x$

$= -3\left(x^2 - \frac{1}{3}x\right)$

$= -3\left(\left(x-\frac{1}{6}\right)^2 - \frac{1}{36}\right)$

$= -3\left(x-\frac{1}{6}\right)^2 + \frac{1}{12}$

軸 $x = \frac{1}{6}$

頂点 $\left(\frac{1}{6}, \frac{1}{12}\right)$