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Complete the following problems. Show all work to receive full credit.

1. Write an equation for the vertical line through  $(0, -\sqrt{2})$ .

Vertical lines are of the form  $x = a$  where  $(a, b)$  is on the line. Therefore, the equation of the vertical line through  $(0, -\sqrt{2})$  is

$$\boxed{x = 0}$$

2. Write the equation of the line through the point  $(-2, 2)$  and perpendicular to the line

$$2x + y = 4.$$

First we want to find the slope of the given line

$$2x + y = 4$$

$$y = -2x + 4$$

Therefore the slope is  $-2$ . The slope of a line perpendicular to that one will be the negative reciprocal, namely  $\frac{1}{2}$ . Therefore we want the equation of the line with slope  $\frac{1}{2}$  through  $(-2, 2)$ , which is

$$y - 2 = \frac{1}{2}(x - (-2))$$

$$\boxed{y - 2 = \frac{1}{2}(x + 2)}$$

The above answer is fine, however it is also correct if you simplified and got:

$$y - 2 = \frac{1}{2}x + 1$$

$$\boxed{y = \frac{1}{2}x + 3}$$

3. Find the value of  $y$  for which the line through  $A(-2, 3)$  and  $B(4, y)$  has slope  $m = -\frac{2}{3}$ .

The slope of the line through  $A$  and  $B$  is:

$$m = \frac{y - 3}{4 - (-2)} = \frac{y - 3}{4 + 2} = \frac{y - 3}{6}$$

We want this slope to be  $-\frac{2}{3}$ , so we solve:

$$\frac{y - 3}{6} = -\frac{2}{3} \Rightarrow -12 = 3(y - 3)$$

$$-12 = 3y - 9 \Rightarrow -3 = 3y$$

$$\boxed{y = -1}$$