3. The slope of the line through $(4, 0, 0)$ and $(0, 0, 2)$ is $(2 - 0)/(0 - 4) = -1/2$, and the slope of the line through $(0, 3, 0)$ and $(0, 0, 2)$ is $(2 - 0)/(0 - 3) = -2/3$, so the desired equation, using the point $(0, 0, 2)$ is

$$z = f(x, y) = 2 - \frac{1}{2}(x - 0) - \frac{2}{3}(y - 0) = 2 - \frac{1}{2}x - \frac{2}{3}y .$$

4. The $z = 2$ in the $xz$-plane is parallel to the $x$-axis, so the desired plane has slope 0 in the $x$-direction — so there is no $x$ in its equation. The equation of the line in the $yz$-plane through $(0, 1, 0)$ and $(0, 0, 2)$ is $z = 2 - 2y$, so this is also the equation of the desired plane.

6. The given line meets the $x$- and $y$-axes in $(0, 4, 0)$ and $(-4/3, 0, 0)$ respectively, so the slopes of the desired plane in the $x$- and $y$-directions are $(5 - 0)/(0 - (-4/3)) = 15/4$ and $(5 - 0)/(0 - 4) = -5/4$ respectively; so the desired equation is

$$z = f(x, y) = 5 + \frac{15}{4}(x - 0) - \frac{5}{4}(y - 0) = 5 + \frac{15}{4}x - \frac{5}{4}y .$$

10. The slope in the $x$-direction is $-1/100$ and the slope in the $y$-direction is $3/10$; and one point on the plane is $(100, 10, 3)$, so the desired equation is

$$z = f(x, y) = 3 - \frac{1}{100}(x - 100) + \frac{3}{10}(y - 10) = 1 - \frac{1}{100}x + \frac{3}{10}y .$$

15. The plane hits the axes at $(3, 0, 0)$, $(0, 2, 0)$, and $(0, 0, 6)$:

16. The plane hits the axes at $(-4, 0, 0)$, $(0, 2, 0)$, and $(0, 0, 4)$:
18. All three, assuming that (s)he sells all (s)he produces. In (a), if the unit price of the raw materials are $c_1$ and $c_2$, then the total amount expended on raw materials is $c_1m_1 + c_2m_2$. In (b) and (c), revenue is $p_1q_1 + p_2q_2$ (I am assuming here that the $p$'s are prices per unit of product). So (b) is linear in the $q$'s; but (c) is not linear, because the product of variables $p_1q_1$ is not a linear term.

19. (a) For such a student, the predicted college GPA is $z = 0.003(1050) + 0.8(3.0) - 4 = 1.55 < 2.3$, so the student will not be admitted.

(b) No: If the student’s high school average is low enough (for example, 0), then even an SAT of 1600 gives only a predicted college GPA of 0.8, so such a student will not be admitted.

(c) No: If a student’s SAT is low enough (for example, 400), then even a high school GPA of 4.3 gives only a predicted college GPA of .64, so such a student will not be admitted.

(d)

(e) An extra 100 points on the SAT adds $0.003(100) = .3$ to the predicted college GPA; an extra 0.5 in high school GPA adds $0.8(0.5) = .4$ to the predicted college GPA. So the latter is more important.