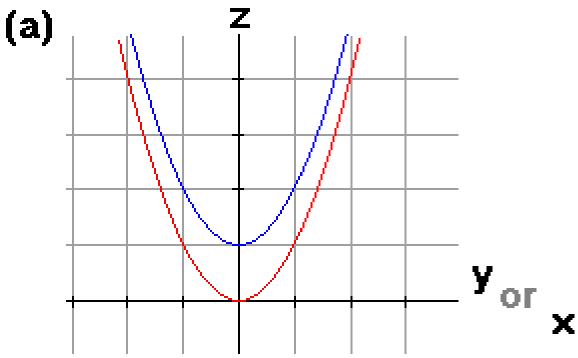
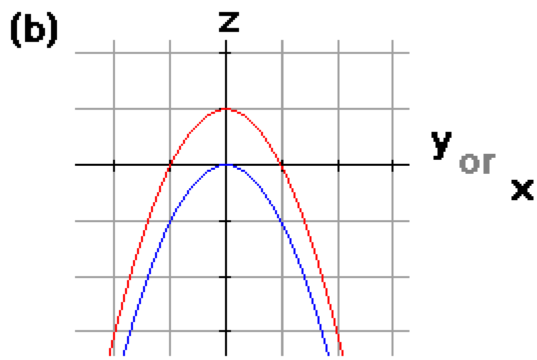
Problems 11.3, Page 19

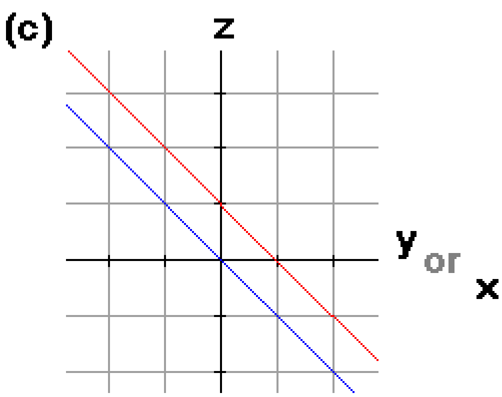
2. (a) (III) (b) (II) (c) (I) (d) (IV)

3. (a) Bowl: As either x or y move away from 0, z increases.
(b) Neither: Similar to (a), but opening downward.
(c) Plate: It's flat (the equation of a plane).

4.Because all the equations are "symmetric" in x and y (i.e., the x- and y-values could be reversed and the z-value is never changed), the cross sections perpendicular to the x-axis and to the y-axis are essentially the same. In these graphs, the red curve results when x or y is fixed at 0 (and the other is allowed to vary), and the blue when one of them is fixed at 1.

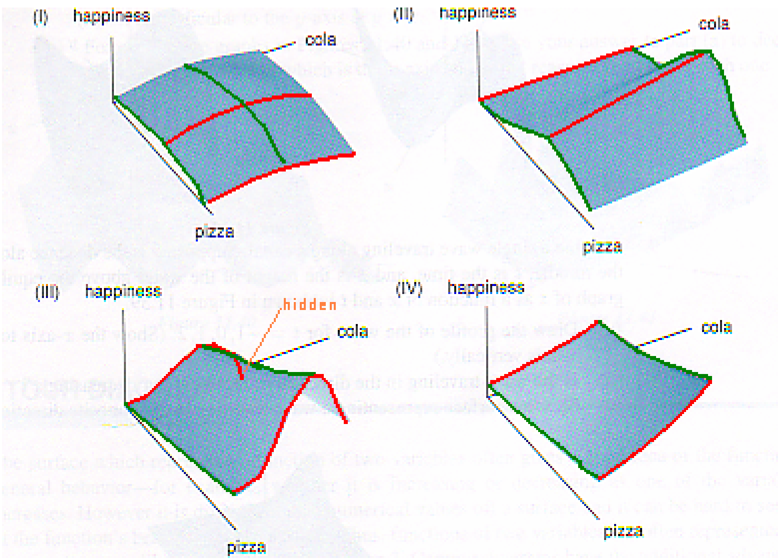






5. (a) (I): There is no point at $x = y = 0$, z is very large when x and y are both small, and as either x or y move away from 0, z approaches 0.
(b) (V): z is always negative, smallest value is $z = -1$ at $x = y = 0$, and as x or y moves away from 0, z approaches 0.
(c) (IV): A plane, because all the cross sections (picking values for one of the variables) are lines.
(d) (II): z-value is independent of x-value, has highest value 0 when $y = 0$.
(e) (III): The cross sections formed when a y-value is fixed clearly have the double curve of the cubing function. Though it is harder to see the effect of the $\sin y$ term in the diagram (the units in the z-direction must be small), it is above the y-axis where y is negative and below where y is positive — clearly not a full cycle of the sine curve is shown in the graph.

7. First, we show where we have taken the cross sections; then we display the cross section graphs themselves:


(I)
happiness
cola
pizza
(II)
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(III)
happiness
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cola
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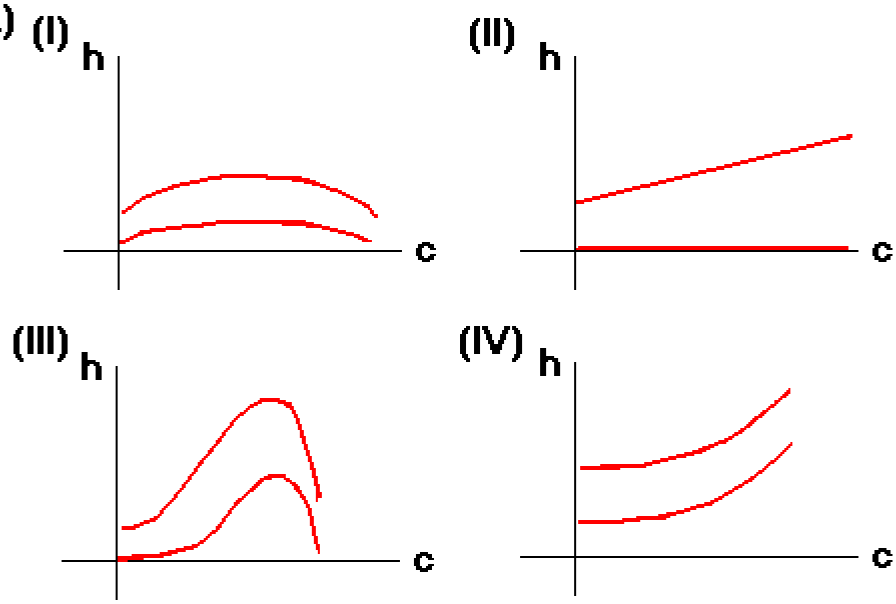
(IV)
happiness
cola
pizza

(a)


(I)
h
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(IV)
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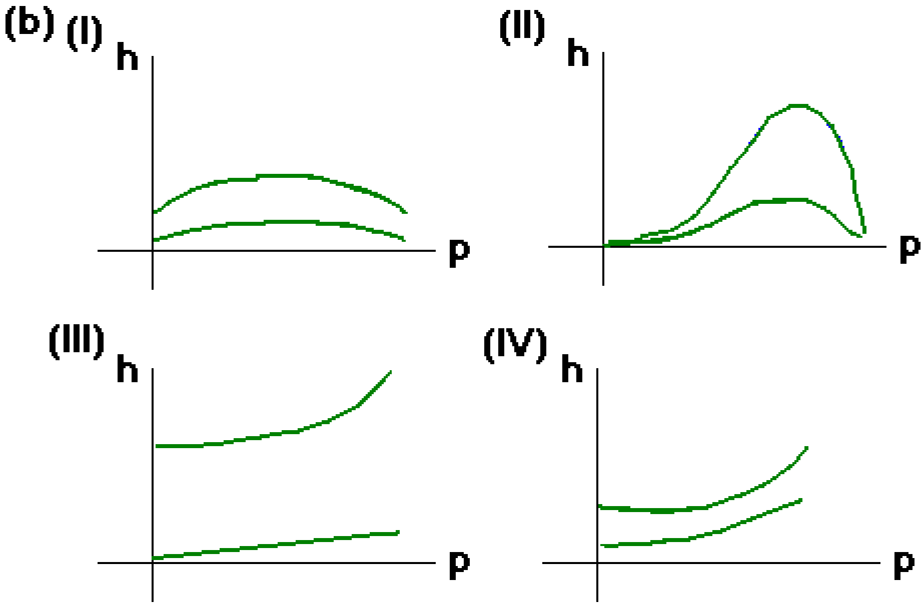
c



8. (IV): For positive y-values — behind the xz-plane in all 4 pictures — the cross sections are parabolas concave up; for $y = 0$ (the xz-plane), the graph is the x-axis; and for $y < 0$ — on the side of the xz-plane facing the reader – the cross sections are parabolas concave down.

14. (a) (i) $E = 1 - \cos c + y^2/2 = k + y^2/2$, where k is the constant $1 - \cos c$, is the equation of a parabola concave upward from the point $(0, k)$. (ii) $E = 1 - \cos x + c^2/2 = k - \cos x$, where k is the constant $1 + c^2/2$, is the negative of the cosine curve centered around the horizontal line $z = k$.
(b) Figure 11.40 has the x-axis going to the right and left, because the cross sections in that direction are cosine curves, and the y-axis coming toward the viewer, because the cross sections in that direction are parabolas. In Figure 11.41, the axis to the right is the y-axis and the axis to the left is the x-axis.