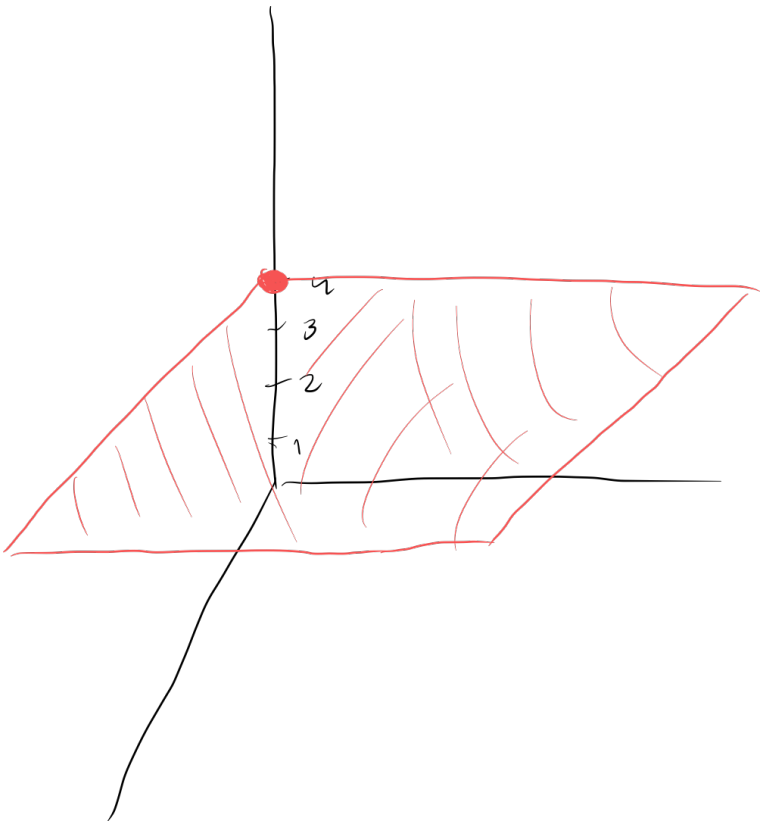
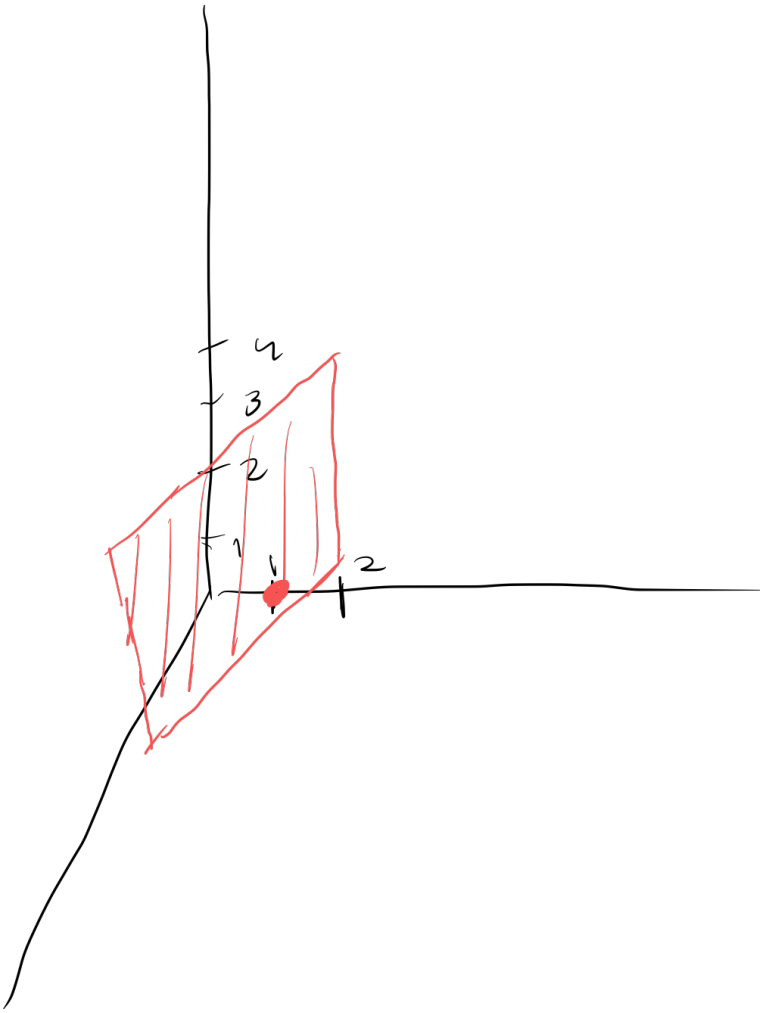
12.1

- 4: B is closest to the yz plane, lies on the xz plane, and is farthest from the xy plane.
- 8: I and IV lie on the graph of $z = 4$.
- 12:



- 14:



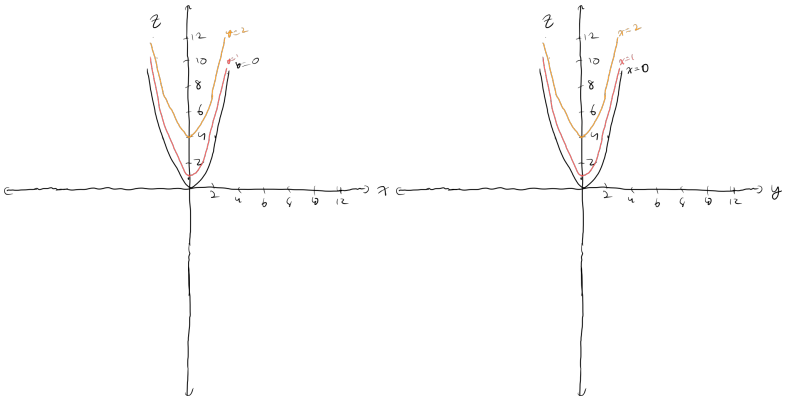
- 26:
  (a) -19°
  (b) 20 mph
  (c) 17 mph
  (d) 16°
- 28:

Temperature (°F)									
Wind Speed (mph)		35	30	25	20	15	10	5	0
	5	31	25	19	13	7	1	−5	−11
	20	24	17	11	4	−2	−9	−15	−22

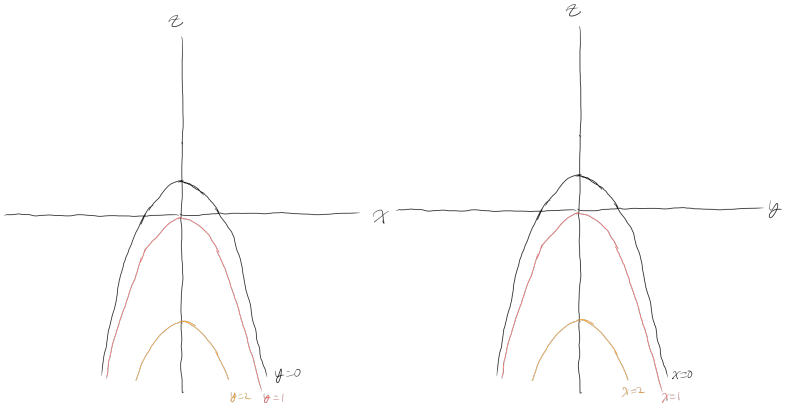
- 32: 24.33
- 34: $W \leq 46.2$ kg
- 38: Gravity acts on a 100 kg mass at 7000 km with approx. 820 newtons of force.
- 58: $(-1, -2, -7)$

12.2

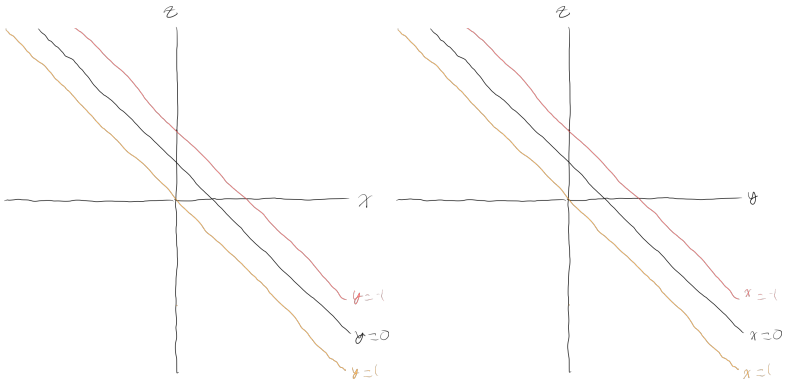
- 2: I, II
- 4: II, III
- 6:
  (a) I
  (b) V
  (c) IV
  (d) II
  (e) III
- 28:
  (a) V
  (b) IX
  (c) VII
  (d) I
  (e) VIII
  (f) II
  (g) VI
  (h) III
  (i) IV
- 30:
  (a) $z = x^2 + y^2$



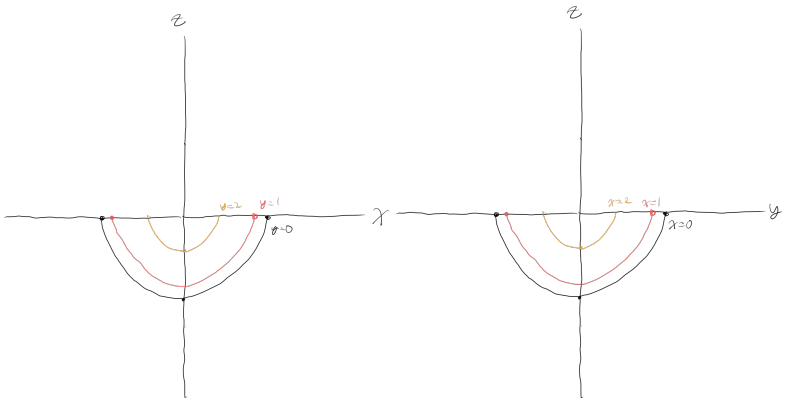
  (b) $z = 1 - x^2 - y^2$



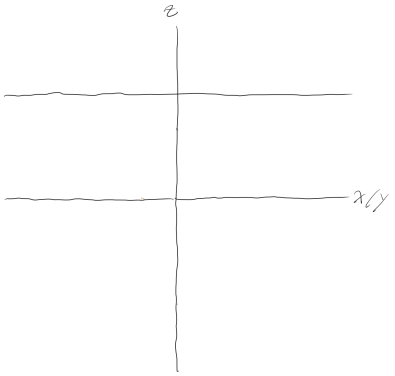
(c) $x + y + z = 1$



(d) $z = -\sqrt{5 - x^2 - y^2}$



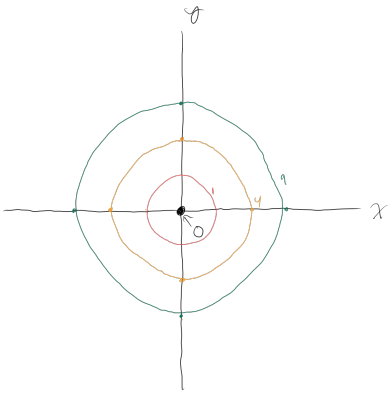
(e) $z = 3$



- 32:
  - (a) IV
  - (b) I
  - (c) III
- 42:
  - (a) The second figure shows the cross sections with T fixed. This means that pressure is inversely proportional volume, holding temperature constant.
  - (b) The first figure shows the cross sections with V fixed. This means that pressure is linearly proportional to temperature, holding volume constant.

12.3

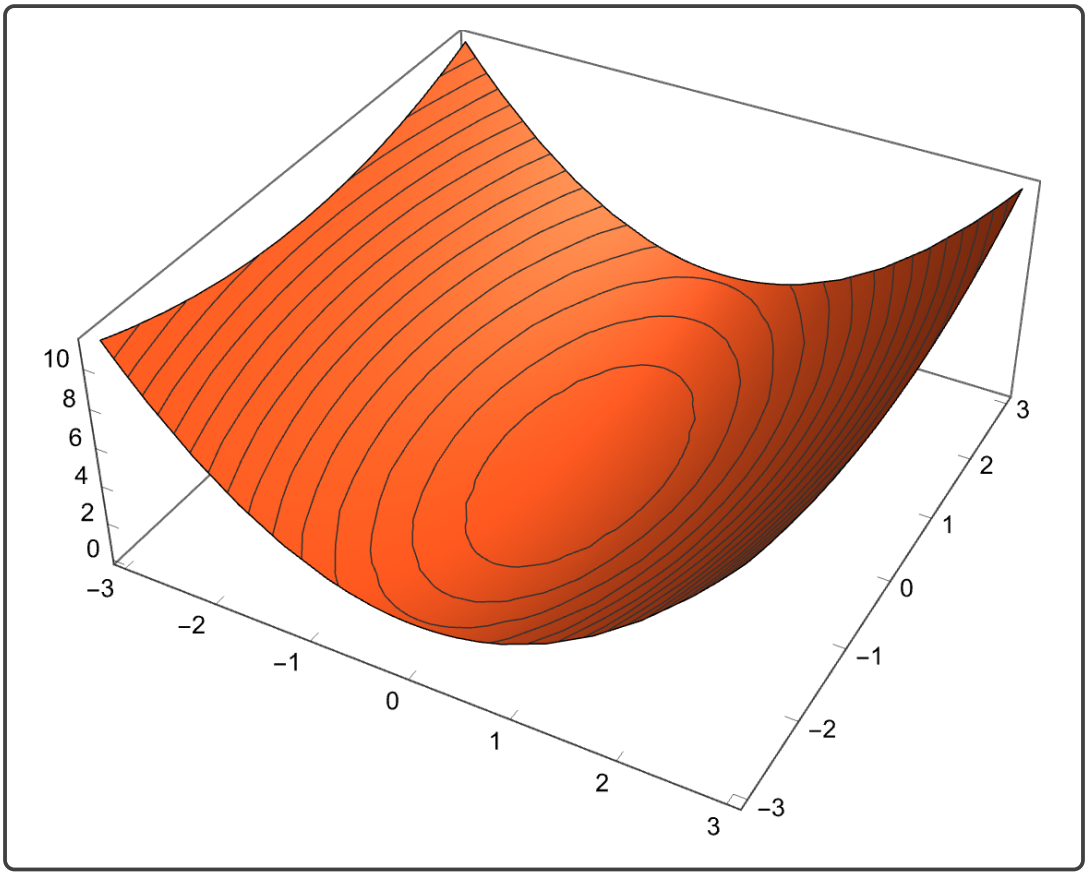
- 6: $f(-2,2) = 4$
- 8: $(x,y) = (-2,0)$
- 12: I, IV, VI
- 16: $f(x,y) = x^2 + y^2$: The contours are circles that grow in value significantly with equally spaced steps in x and y.



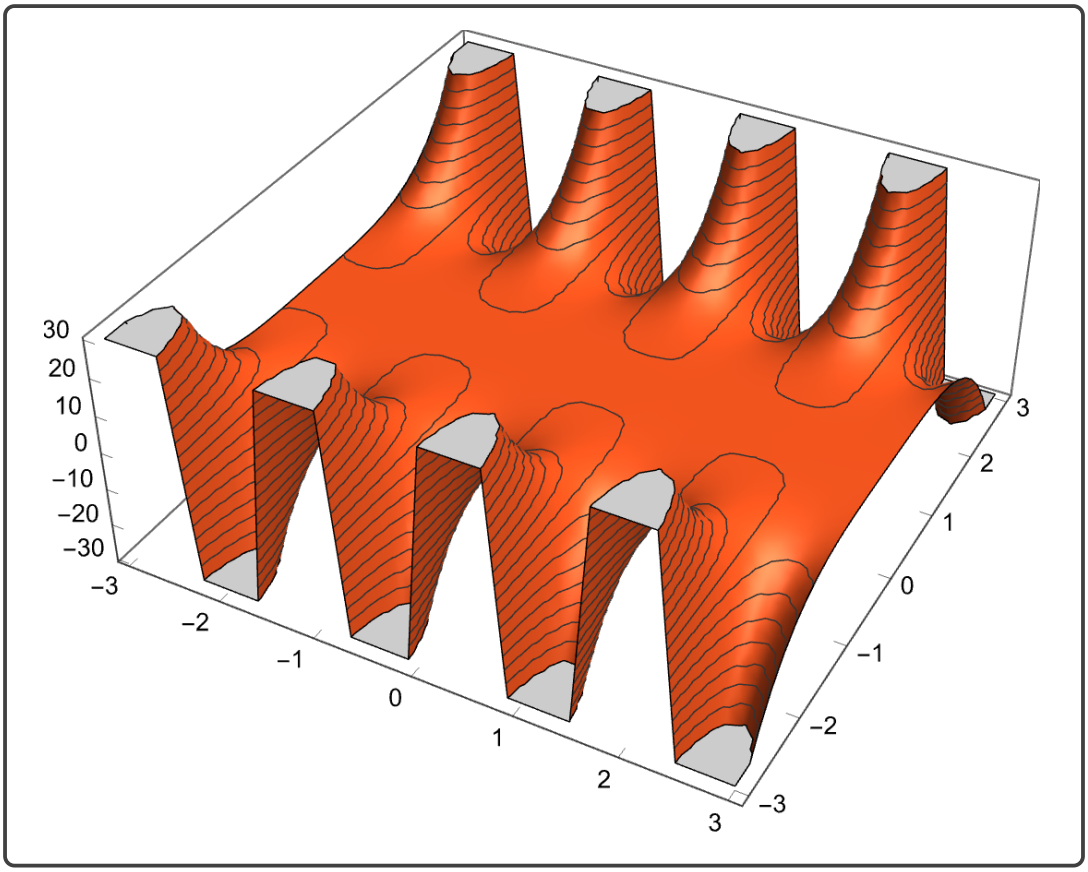
- 28: From left to right, the values of the contours are $100, 150, 200, 250$.
- 36:
  (a) Path A will be a steeper climb than path B.
  (b) On path A, you will have a wider view of the horizon.
  (c) Path B is more likely to have a stream.

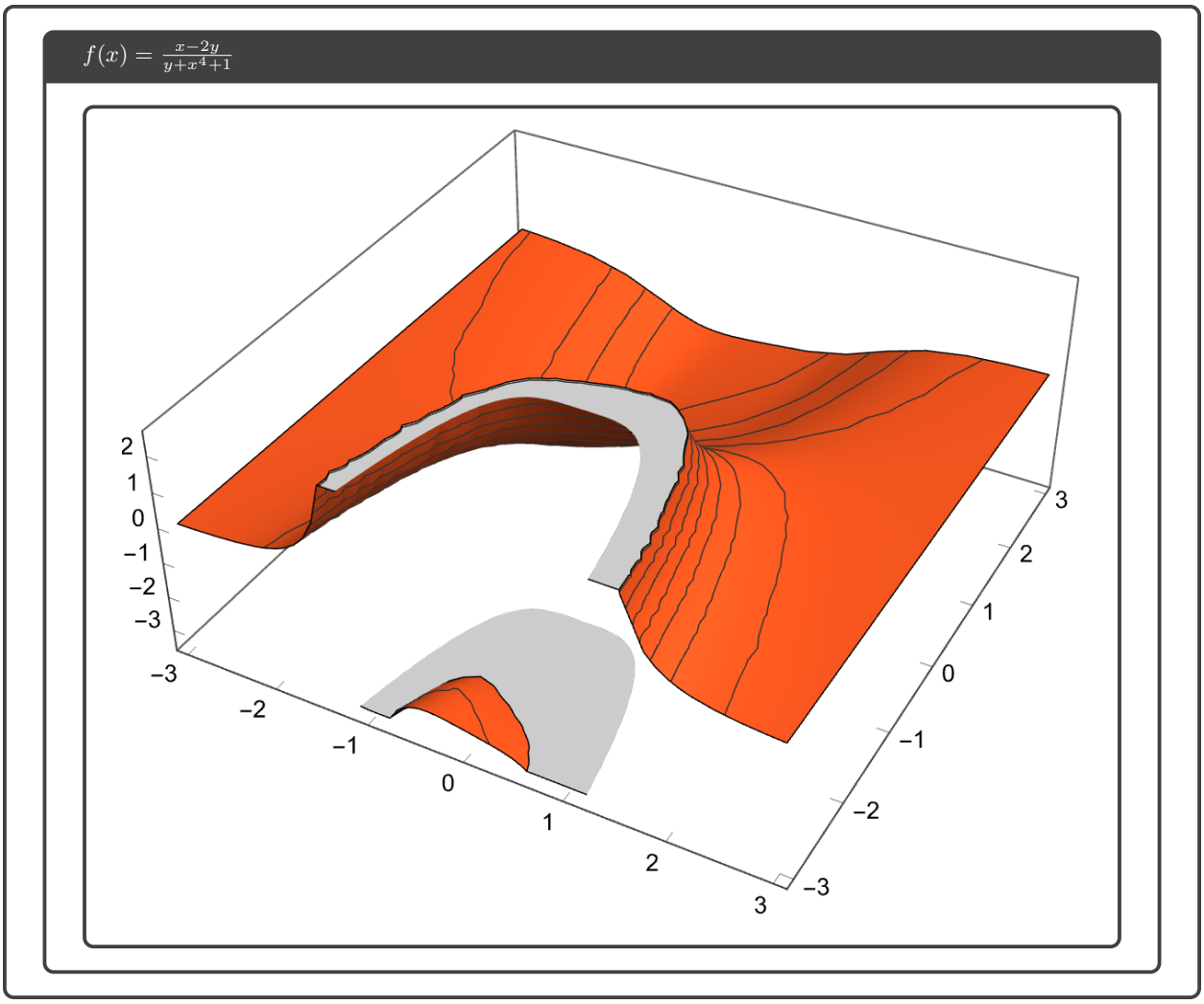
Mathematica Plotting

$f(x, y) = x^2 + y^2/4$



$f(x, y) = \sin(4x)y^4$




$f(x) = \frac{x-2y}{y+x^4+1}$
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2
3
3
2
1
0
−1
−2
−3