

# Kvadratické formy

Rozhodněte, zda je daná kvadratická forma PD, PSD, ND, NSD nebo indef.:

1.  $q(x, y, z) = 9x^2 + 12xy - 18xz + 8y^2 - 24yz + 18z^2$
2.  $q(x, y, z) = -x^2 + 6xy + 6xz - 10y^2 - 16yz - 10z^2$
3.  $q(x, y, z) = x^2 + 6xy + 6xz + 8y^2 + 22yz + 6z^2$
4.  $q(x, y, z) = 4x^2 - 4xy + 4xz + 5y^2 + 10yz + 11z^2$
5.  $q(x, y, z) = -4x^2 - 12xy - 12xz - 18y^2 - 30yz - 14z^2$
6.  $q(x, y, z) = x^2 + 6xy - 2xz + 18y^2 + 2z^2$
7.  $q(x, y, z) = -9x^2 + 18xy - 18xz - 18y^2 + 36yz - 18z^2$
8.  $q(x, y, z) = x^2 + 6xy + 6xz + 5y^2 + 6yz + z^2$
9.  $q(x, y, z) = x^2 + 4xy + 2xz + 8y^2 + 8yz + 3z^2$
10.  $q(x, y, z) = -x^2 - 6xy + 6xz - 13y^2 + 30yz - 19z^2$
11.  $q(x, y, z) = 4x^2 + 12xy - 12xz + 10y^2 - 22yz + 13z^2$
12.  $q(x, y, z) = -x^2 + 4xy - 6xz - 13y^2 + 24yz - 13z^2$
13.  $q(x, y, z) = x^2 + 6xy - 2xz - 24yz - 7z^2$
14.  $q(x, y, z) = x^2 + 6xy - 4xz + 18y^2 - 24yz + 9z^2$
15.  $q(x, y, z) = -9x^2 + 12xy + 6xz - 13y^2 - 16yz - 6z^2$
16.  $q(x, y, z) = 9x^2 + 18xy - 18xz + 18y^2 - 12yz + 10z^2$
17.  $q(x, y, z) = -4x^2 + 4xy + 8xz - 5y^2 - 12yz - 8z^2$
18.  $q(x, y, z) = 9x^2 - 12xy - 6xz + 3y^2 + 8yz - 2z^2$
19.  $q(x, y, z) = 4x^2 - 12xy + 12xz + 18y^2 - 12yz + 11z^2$
20.  $q(x, y, z) = -4x^2 + 4xy - 8xz - 2y^2 - 2yz - 14z^2$
21.  $q(x, y, z) = x^2 + 6xy - 4xz + 18y^2 - 18yz + 5z^2$
22.  $q(x, y, z) = -4x^2 + 8xy + 8xz - 8y^2 + 4yz - 13z^2$
23.  $q(x, y, z) = 4x^2 + 8xy + 4xz + 3y^2 - 2z^2$
24.  $q(x, y, z) = x^2 - 6xy - 2xz + 18y^2 + 24yz + 11z^2$
25.  $q(x, y, z) = -4x^2 - 8xy - 12xz - 8y^2 - 19z^2$

26.  $q(x, y, z) = 9x^2 + 18xy + 6xz + 10y^2 + 4yz + 2z^2$
27.  $q(x, y, z) = -x^2 + 4xy - 6xz - 5y^2 + 8yz - 13z^2$
28.  $q(x, y, z) = x^2 + 4xy - 4xz - 20yz - 4z^2$
29.  $q(x, y, z) = 4x^2 - 12xy + 4xz + 18y^2 + 12yz + 11z^2$
30.  $q(x, y, z) = -x^2 + 2xy - 6xz - 10y^2 + 24yz - 19z^2$
31.  $q(x, y, z) = x^2 + 4xy + 4xz + 13y^2 + 14yz + 5z^2$
32.  $q(x, y, z) = -9x^2 + 12xy + 18xz - 8y^2 - 24yz - 18z^2$
33.  $q(x, y, z) = 4x^2 - 12xy + 12xz - 24yz + 9z^2$
34.  $q(x, y, z) = x^2 - 2xy + 4xz + 10y^2 - 10yz + 6z^2$
35.  $q(x, y, z) = -9x^2 + 18xy - 12xz - 13y^2 + 20yz - 9z^2$
36.  $q(x, y, z) = 9x^2 + 18xy + 18xz + 10y^2 + 16yz + 10z^2$
37.  $q(x, y, z) = -x^2 + 6xy + 2xz - 13y^2 + 2yz - 5z^2$
38.  $q(x, y, z) = x^2 - 2xy - 4xz + 6yz + 4z^2$
39.  $q(x, y, z) = x^2 - 6xy - 2xz + 10y^2 + 11z^2$
40.  $q(x, y, z) = -9x^2 + 6xy + 12xz - 2y^2 - 9z^2$

1. PSD

$$q(x, y, z) = 9x^2 + 12xy - 18xz + 8y^2 - 24yz + 18z^2 \\ (3x + 2y - 3z)^2 + (2y - 3z)^2$$

$$\mathbf{A} = \begin{pmatrix} 9 & 6 & -9 \\ 6 & 8 & -12 \\ -9 & -12 & 18 \end{pmatrix}$$

$$\Delta_1 = 9, \Delta_2 = 36, \Delta_3 = 0$$

$$p = L^3 - 35L^2 + 117L$$

$$\bar{\lambda} = (0.00000, 3.74318, 31.25682)$$

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2. NSD

$$q(x, y, z) = -x^2 + 6xy + 6xz - 10y^2 - 16yz - 10z^2 \\ -(-x + 3y + 3z)^2 - (y - z)^2$$

$$\mathbf{A} = \begin{pmatrix} -1 & 3 & 3 \\ 3 & -10 & -8 \\ 3 & -8 & -10 \end{pmatrix}$$

$$p = L^3 + 21L^2 + 38L$$

$$\bar{\lambda} = (-19.00000, -2.00000, 0.00000)$$

$$\Delta_1 = -1, \Delta_2 = 1, \Delta_3 = 0$$

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3. indef

$$q(x, y, z) = x^2 + 6xy + 6xz + 8y^2 + 22yz + 6z^2 \\ (x + 3y + 3z)^2 - (y - 2z)^2 + z^2$$

$$\mathbf{A} = \begin{pmatrix} 1 & 3 & 3 \\ 3 & 8 & 11 \\ 3 & 11 & 6 \end{pmatrix}$$

$$p = L^3 - 15L^2 - 77L + 1$$

$$\bar{\lambda} = (-4.05408, 0.01295, 19.04112)$$

$$\Delta_1 = 1, \Delta_2 = -1, \Delta_3 = -1$$

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4. PD

$$q(x, y, z) = 4x^2 - 4xy + 4xz + 5y^2 + 10yz + 11z^2 \\ (-2x + y - z)^2 + (2y + 3z)^2 + z^2$$

$$A = \begin{pmatrix} 4 & -2 & 2 \\ -2 & 5 & 5 \\ 2 & 5 & 11 \end{pmatrix}$$

$$p = L^3 - 20L^2 + 86L - 16$$

$$\bar{\lambda} = (0.19478, 5.91270, 13.89252)$$

$$\Delta_1 = 4, \Delta_2 = 16, \Delta_3 = 16$$

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5. ND

$$q(x, y, z) = -4x^2 - 12xy - 12xz - 18y^2 - 30yz - 14z^2 \\ -(-2x - 3y - 3z)^2 - (-3y - 2z)^2 - z^2$$

$$A = \begin{pmatrix} -4 & -6 & -6 \\ -6 & -18 & -15 \\ -6 & -15 & -14 \end{pmatrix}$$

$$p = L^3 + 36L^2 + 83L + 36$$

$$\bar{\lambda} = (-33.55869, -1.86661, -0.57470)$$

$$\Delta_1 = -4, \Delta_2 = 36, \Delta_3 = -36$$

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6. PSD

$$q(x, y, z) = x^2 + 6xy - 2xz + 18y^2 + 2z^2 \\ (x + 3y - z)^2 + (3y + z)^2$$

$$A = \begin{pmatrix} 1 & 3 & -1 \\ 3 & 18 & 0 \\ -1 & 0 & 2 \end{pmatrix}$$

$$p = L^3 - 21L^2 + 46L$$

$$\bar{\lambda} = (0.00000, 2.48439, 18.51561)$$

$$\Delta_1 = 1, \Delta_2 = 9, \Delta_3 = 0$$

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7. NSD

$$q(x, y, z) = -9x^2 + 18xy - 18xz - 18y^2 + 36yz - 18z^2 \\ - (-3x + 3y - 3z)^2 - (3y - 3z)^2$$

$$A = \begin{pmatrix} -9 & 9 & -9 \\ 9 & -18 & 18 \\ -9 & 18 & -18 \end{pmatrix}$$

$$p = L^3 + 45L^2 + 162L$$

$$\bar{\lambda} = (-41.05398, -3.94602, 0.00000)$$

$$\Delta_1 = -9, \Delta_2 = 81, \Delta_3 = 0$$

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8. indef

$$q(x, y, z) = x^2 + 6xy + 6xz + 5y^2 + 6yz + z^2 \\ (x + 3y + 3z)^2 - (2y + 3z)^2 + z^2$$

$$A = \begin{pmatrix} 1 & 3 & 3 \\ 3 & 5 & 3 \\ 3 & 3 & 1 \end{pmatrix}$$

$$p = L^3 - 7L^2 - 16L + 4$$

$$\bar{\lambda} = (-2.00000, 0.22800, 8.77200)$$

$$\Delta_1 = 1, \Delta_2 = -4, \Delta_3 = -4$$

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9. PD

$$q(x, y, z) = x^2 + 4xy + 2xz + 8y^2 + 8yz + 3z^2 \\ (-x - 2y - z)^2 + (2y + z)^2 + z^2$$

$$A = \begin{pmatrix} 1 & 2 & 1 \\ 2 & 8 & 4 \\ 1 & 4 & 3 \end{pmatrix}$$

$$p = L^3 - 12L^2 + 14L - 4$$

$$\bar{\lambda} = (0.46052, 0.80949, 10.72999)$$

$$\Delta_1 = 1, \Delta_2 = 4, \Delta_3 = 4$$

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10. ND

$$q(x, y, z) = -x^2 - 6xy + 6xz - 13y^2 + 30yz - 19z^2 \\ - (x + 3y - 3z)^2 - (2y - 3z)^2 - z^2$$

$$\mathbf{A} = \begin{pmatrix} -1 & -3 & 3 \\ -3 & -13 & 15 \\ 3 & 15 & -19 \end{pmatrix}$$

$$p = L^3 + 33L^2 + 36L + 4$$

$$\bar{\lambda} = (-31.87451, -1.00000, -0.12549)$$

$$\Delta_1 = -1, \Delta_2 = 4, \Delta_3 = -4$$

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11. PSD

$$q(x, y, z) = 4x^2 + 12xy - 12xz + 10y^2 - 22yz + 13z^2 \\ (-2x - 3y + 3z)^2 + (-y + 2z)^2$$

$$\mathbf{A} = \begin{pmatrix} 4 & 6 & -6 \\ 6 & 10 & -11 \\ -6 & -11 & 13 \end{pmatrix}$$

$$p = L^3 - 27L^2 + 29L$$

$$\bar{\lambda} = (0.00000, 1.12058, 25.87942)$$

$$\Delta_1 = 4, \Delta_2 = 4, \Delta_3 = 0$$

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12. NSD

$$q(x, y, z) = -x^2 + 4xy - 6xz - 13y^2 + 24yz - 13z^2 \\ - (x - 2y + 3z)^2 - (3y - 2z)^2$$

$$\mathbf{A} = \begin{pmatrix} -1 & 2 & -3 \\ 2 & -13 & 12 \\ -3 & 12 & -13 \end{pmatrix}$$

$$p = L^3 + 27L^2 + 38L$$

$$\bar{\lambda} = (-25.51041, -1.48959, 0.00000)$$

$$\Delta_1 = -1, \Delta_2 = 9, \Delta_3 = 0$$

---

13. indef

$$q(x, y, z) = x^2 + 6xy - 2xz - 24yz - 7z^2$$

$$(-x - 3y + z)^2 - (-3y - 3z)^2 + z^2$$

$$\mathbf{A} = \begin{pmatrix} 1 & 3 & -1 \\ 3 & 0 & -12 \\ -1 & -12 & -7 \end{pmatrix}$$

$$p = L^3 + 6L^2 - 161L + 9$$

$$\bar{\lambda} = (-16.05988, 0.05602, 10.00386)$$

$$\Delta_1 = 1, \Delta_2 = -9, \Delta_3 = -9$$

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14. PD

$$q(x, y, z) = x^2 + 6xy - 4xz + 18y^2 - 24yz + 9z^2$$

$$(x + 3y - 2z)^2 + (-3y + 2z)^2 + z^2$$

$$\mathbf{A} = \begin{pmatrix} 1 & 3 & -2 \\ 3 & 18 & -12 \\ -2 & -12 & 9 \end{pmatrix}$$

$$p = L^3 - 28L^2 + 32L - 9$$

$$\bar{\lambda} = (0.47671, 0.70394, 26.81934)$$

$$\Delta_1 = 1, \Delta_2 = 9, \Delta_3 = 9$$

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15. ND

$$q(x, y, z) = -9x^2 + 12xy + 6xz - 13y^2 - 16yz - 6z^2$$

$$-(-3x + 2y + z)^2 - (-3y - 2z)^2 - z^2$$

$$\mathbf{A} = \begin{pmatrix} -9 & 6 & 3 \\ 6 & -13 & -8 \\ 3 & -8 & -6 \end{pmatrix}$$

$$p = L^3 + 28L^2 + 140L + 81$$

$$\bar{\lambda} = (-21.72838, -5.60673, -0.66489)$$

$$\Delta_1 = -9, \Delta_2 = 81, \Delta_3 = -81$$

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16. PSD

$$q(x, y, z) = 9x^2 + 18xy - 18xz + 18y^2 - 12yz + 10z^2$$

$$(-3x - 3y + 3z)^2 + (3y + z)^2$$

$$\mathbf{A} = \begin{pmatrix} 9 & 9 & -9 \\ 9 & 18 & -6 \\ -9 & -6 & 10 \end{pmatrix}$$

$$p = L^3 - 37L^2 + 234L$$

$$\bar{\lambda} = (0.00000, 8.09567, 28.90433)$$

$$\Delta_1 = 9, \Delta_2 = 81, \Delta_3 = 0$$

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17. NSD

$$q(x, y, z) = -4x^2 + 4xy + 8xz - 5y^2 - 12yz - 8z^2$$

$$-(-2x + y + 2z)^2 - (-2y - 2z)^2$$

$$\mathbf{A} = \begin{pmatrix} -4 & 2 & 4 \\ 2 & -5 & -6 \\ 4 & -6 & -8 \end{pmatrix}$$

$$p = L^3 + 17L^2 + 36L$$

$$\bar{\lambda} = (-14.52080, -2.47920, 0.00000)$$

$$\Delta_1 = -4, \Delta_2 = 16, \Delta_3 = 0$$

---

18. indef

$$q(x, y, z) = 9x^2 - 12xy - 6xz + 3y^2 + 8yz - 2z^2$$

$$(-3x + 2y + z)^2 - (-y + 2z)^2 + z^2$$

$$\mathbf{A} = \begin{pmatrix} 9 & -6 & -3 \\ -6 & 3 & 4 \\ -3 & 4 & -2 \end{pmatrix}$$

$$p = L^3 - 10L^2 - 58L + 9$$

$$\bar{\lambda} = (-4.22656, 0.15129, 14.07527)$$

$$\Delta_1 = 9, \Delta_2 = -9, \Delta_3 = -9$$

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19. PD

$$q(x, y, z) = 4x^2 - 12xy + 12xz + 18y^2 - 12yz + 11z^2 \\ (2x - 3y + 3z)^2 + (-3y - z)^2 + z^2$$

$$\mathbf{A} = \begin{pmatrix} 4 & -6 & 6 \\ -6 & 18 & -6 \\ 6 & -6 & 11 \end{pmatrix}$$

$$p = L^3 - 33L^2 + 206L - 36$$

$$\bar{\lambda} = (0.17991, 8.09173, 24.72835)$$

$$\Delta_1 = 4, \Delta_2 = 36, \Delta_3 = 36$$

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20. ND

$$q(x, y, z) = -4x^2 + 4xy - 8xz - 2y^2 - 2yz - 14z^2 \\ -(2x - y + 2z)^2 - (-y - 3z)^2 - z^2$$

$$\mathbf{A} = \begin{pmatrix} -4 & 2 & -4 \\ 2 & -2 & -1 \\ -4 & -1 & -14 \end{pmatrix}$$

$$p = L^3 + 20L^2 + 71L + 4$$

$$\bar{\lambda} = (-15.40921, -4.53353, -0.05726)$$

$$\Delta_1 = -4, \Delta_2 = 4, \Delta_3 = -4$$

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21. PSD

$$q(x, y, z) = x^2 + 6xy - 4xz + 18y^2 - 18yz + 5z^2 \\ (-x - 3y + 2z)^2 + (-3y + z)^2$$

$$\mathbf{A} = \begin{pmatrix} 1 & 3 & -2 \\ 3 & 18 & -9 \\ -2 & -9 & 5 \end{pmatrix}$$

$$p = L^3 - 24L^2 + 19L$$

$$\bar{\lambda} = (0.00000, 0.81966, 23.18034)$$

$$\Delta_1 = 1, \Delta_2 = 9, \Delta_3 = 0$$

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22. NSD

$$q(x, y, z) = -4x^2 + 8xy + 8xz - 8y^2 + 4yz - 13z^2 \\ - (-2x + 2y + 2z)^2 - (2y - 3z)^2$$

$$A = \begin{pmatrix} -4 & 4 & 4 \\ 4 & -8 & 2 \\ 4 & 2 & -13 \end{pmatrix}$$

$$p = L^3 + 25L^2 + 152L$$

$$\bar{\lambda} = (-14.56155, -10.43845, 0.00000)$$

$$\Delta_1 = -4, \Delta_2 = 16, \Delta_3 = 0$$

---

23. indef

$$q(x, y, z) = 4x^2 + 8xy + 4xz + 3y^2 - 2z^2 \\ (2x + 2y + z)^2 - (y + 2z)^2 + z^2$$

$$A = \begin{pmatrix} 4 & 4 & 2 \\ 4 & 3 & 0 \\ 2 & 0 & -2 \end{pmatrix}$$

$$p = L^3 - 5L^2 - 22L + 4$$

$$\bar{\lambda} = (-2.94149, 0.17509, 7.76640)$$

$$\Delta_1 = 4, \Delta_2 = -4, \Delta_3 = -4$$

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24. PD

$$q(x, y, z) = x^2 - 6xy - 2xz + 18y^2 + 24yz + 11z^2 \\ (x - 3y - z)^2 + (-3y - 3z)^2 + z^2$$

$$A = \begin{pmatrix} 1 & -3 & -1 \\ -3 & 18 & 12 \\ -1 & 12 & 11 \end{pmatrix}$$

$$p = L^3 - 30L^2 + 73L - 9$$

$$\bar{\lambda} = (0.13023, 2.52760, 27.34217)$$

$$\Delta_1 = 1, \Delta_2 = 9, \Delta_3 = 9$$

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25. ND

$$q(x, y, z) = -4x^2 - 8xy - 12xz - 8y^2 - 19z^2 \\ - (-2x - 2y - 3z)^2 - (2y - 3z)^2 - z^2$$

$$\mathbf{A} = \begin{pmatrix} -4 & -4 & -6 \\ -4 & -8 & 0 \\ -6 & 0 & -19 \end{pmatrix}$$

$$p = L^3 + 31L^2 + 208L + 16$$

$$\bar{\lambda} = (-21.24483, -9.67734, -0.07782)$$

$$\Delta_1 = -4, \Delta_2 = 16, \Delta_3 = -16$$

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26. PSD

$$q(x, y, z) = 9x^2 + 18xy + 6xz + 10y^2 + 4yz + 2z^2 \\ (3x + 3y + z)^2 + (y - z)^2$$

$$\mathbf{A} = \begin{pmatrix} 9 & 9 & 3 \\ 9 & 10 & 2 \\ 3 & 2 & 2 \end{pmatrix}$$

$$p = L^3 - 21L^2 + 34L$$

$$\bar{\lambda} = (0.00000, 1.76788, 19.23212)$$

$$\Delta_1 = 9, \Delta_2 = 9, \Delta_3 = 0$$

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27. NSD

$$q(x, y, z) = -x^2 + 4xy - 6xz - 5y^2 + 8yz - 13z^2 \\ - (x - 2y + 3z)^2 - (-y - 2z)^2$$

$$\mathbf{A} = \begin{pmatrix} -1 & 2 & -3 \\ 2 & -5 & 4 \\ -3 & 4 & -13 \end{pmatrix}$$

$$p = L^3 + 19L^2 + 54L$$

$$\bar{\lambda} = (-15.52080, -3.47920, 0.00000)$$

$$\Delta_1 = -1, \Delta_2 = 1, \Delta_3 = 0$$

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28. indef

$$q(x, y, z) = x^2 + 4xy - 4xz - 20yz - 4z^2$$

$$(-x - 2y + 2z)^2 - (2y + 3z)^2 + z^2$$

$$\mathbf{A} = \begin{pmatrix} 1 & 2 & -2 \\ 2 & 0 & -10 \\ -2 & -10 & -4 \end{pmatrix}$$

$$p = L^3 + 3L^2 - 112L + 4$$

$$\bar{\lambda} = (-12.20410, 0.03575, 9.16835)$$

$$\Delta_1 = 1, \Delta_2 = -4, \Delta_3 = -4$$

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29. PD

$$q(x, y, z) = 4x^2 - 12xy + 4xz + 18y^2 + 12yz + 11z^2$$

$$(2x - 3y + z)^2 + (3y + 3z)^2 + z^2$$

$$\mathbf{A} = \begin{pmatrix} 4 & -6 & 2 \\ -6 & 18 & 6 \\ 2 & 6 & 11 \end{pmatrix}$$

$$p = L^3 - 33L^2 + 238L - 36$$

$$\bar{\lambda} = (0.15456, 10.35788, 22.48756)$$

$$\Delta_1 = 4, \Delta_2 = 36, \Delta_3 = 36$$

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30. ND

$$q(x, y, z) = -x^2 + 2xy - 6xz - 10y^2 + 24yz - 19z^2$$

$$-(x - y + 3z)^2 - (3y - 3z)^2 - z^2$$

$$\mathbf{A} = \begin{pmatrix} -1 & 1 & -3 \\ 1 & -10 & 12 \\ -3 & 12 & -19 \end{pmatrix}$$

$$p = L^3 + 30L^2 + 65L + 9$$

$$\bar{\lambda} = (-27.66196, -2.18943, -0.14860)$$

$$\Delta_1 = -1, \Delta_2 = 9, \Delta_3 = -9$$

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31. PSD

$$q(x, y, z) = x^2 + 4xy + 4xz + 13y^2 + 14yz + 5z^2 \\ (x + 2y + 2z)^2 + (-3y - z)^2$$

$$A = \begin{pmatrix} 1 & 2 & 2 \\ 2 & 13 & 7 \\ 2 & 7 & 5 \end{pmatrix}$$

$$p = L^3 - 19L^2 + 26L$$

$$\bar{\lambda} = (0.00000, 1.48439, 17.51561)$$

$$\Delta_1 = 1, \Delta_2 = 9, \Delta_3 = 0$$

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32. NSD

$$q(x, y, z) = -9x^2 + 12xy + 18xz - 8y^2 - 24yz - 18z^2 \\ -(-3x + 2y + 3z)^2 - (-2y - 3z)^2$$

$$A = \begin{pmatrix} -9 & 6 & 9 \\ 6 & -8 & -12 \\ 9 & -12 & -18 \end{pmatrix}$$

$$p = L^3 + 35L^2 + 117L$$

$$\bar{\lambda} = (-31.25682, -3.74318, 0.00000)$$

$$\Delta_1 = -9, \Delta_2 = 36, \Delta_3 = 0$$

---

33. indef

$$q(x, y, z) = 4x^2 - 12xy + 12xz - 24yz + 9z^2 \\ (2x - 3y + 3z)^2 - (3y + z)^2 + z^2$$

$$A = \begin{pmatrix} 4 & -6 & 6 \\ -6 & 0 & -12 \\ 6 & -12 & 9 \end{pmatrix}$$

$$p = L^3 - 13L^2 - 180L + 36$$

$$\bar{\lambda} = (-8.54863, 0.19723, 21.35139)$$

$$\Delta_1 = 4, \Delta_2 = -36, \Delta_3 = -36$$

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34. PD

$$q(x, y, z) = x^2 - 2xy + 4xz + 10y^2 - 10yz + 6z^2 \\ (-x + y - 2z)^2 + (-3y + z)^2 + z^2$$

$$\mathbf{A} = \begin{pmatrix} 1 & -1 & 2 \\ -1 & 10 & -5 \\ 2 & -5 & 6 \end{pmatrix}$$

$$p = L^3 - 17L^2 + 46L - 9$$

$$\bar{\lambda} = (0.21206, 3.10069, 13.68725)$$

$$\Delta_1 = 1, \Delta_2 = 9, \Delta_3 = 9$$

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35. ND

$$q(x, y, z) = -9x^2 + 18xy - 12xz - 13y^2 + 20yz - 9z^2 \\ -(-3x + 3y - 2z)^2 - (-2y + 2z)^2 - z^2$$

$$\mathbf{A} = \begin{pmatrix} -9 & 9 & -6 \\ 9 & -13 & 10 \\ -6 & 10 & -9 \end{pmatrix}$$

$$p = L^3 + 31L^2 + 98L + 36$$

$$\bar{\lambda} = (-27.48165, -3.09511, -0.42324)$$

$$\Delta_1 = -9, \Delta_2 = 36, \Delta_3 = -36$$

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36. PSD

$$q(x, y, z) = 9x^2 + 18xy + 18xz + 10y^2 + 16yz + 10z^2 \\ (-3x - 3y - 3z)^2 + (-y + z)^2$$

$$\mathbf{A} = \begin{pmatrix} 9 & 9 & 9 \\ 9 & 10 & 8 \\ 9 & 8 & 10 \end{pmatrix}$$

$$p = L^3 - 29L^2 + 54L$$

$$\bar{\lambda} = (0.00000, 2.00000, 27.00000)$$

$$\Delta_1 = 9, \Delta_2 = 9, \Delta_3 = 0$$

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37. NSD

$$q(x, y, z) = -x^2 + 6xy + 2xz - 13y^2 + 2yz - 5z^2 \\ - (x - 3y - z)^2 - (-2y + 2z)^2$$

$$\mathbf{A} = \begin{pmatrix} -1 & 3 & 1 \\ 3 & -13 & 1 \\ 1 & 1 & -5 \end{pmatrix}$$

$$\bar{\lambda} = (-13.77200, -5.22800, 0.00000)$$

$$p = L^3 + 19L^2 + 72L$$

$$\Delta_1 = -1, \Delta_2 = 4, \Delta_3 = 0$$

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38. indef

$$q(x, y, z) = x^2 - 2xy - 4xz + 6yz + 4z^2 \\ (x - y - 2z)^2 - (-y + z)^2 + z^2$$

$$\mathbf{A} = \begin{pmatrix} 1 & -1 & -2 \\ -1 & 0 & 3 \\ -2 & 3 & 4 \end{pmatrix}$$

$$p = L^3 - 5L^2 - 10L + 1$$

$$\bar{\lambda} = (-1.60756, 0.09552, 6.51204)$$

$$\Delta_1 = 1, \Delta_2 = -1, \Delta_3 = -1$$

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39. PD

$$q(x, y, z) = x^2 - 6xy - 2xz + 10y^2 + 11z^2 \\ (x - 3y - z)^2 + (y - 3z)^2 + z^2$$

$$\mathbf{A} = \begin{pmatrix} 1 & -3 & -1 \\ -3 & 10 & 0 \\ -1 & 0 & 11 \end{pmatrix}$$

$$p = L^3 - 22L^2 + 121L - 1$$

$$\bar{\lambda} = (0.00828, 10.69421, 11.29751)$$

$$\Delta_1 = 1, \Delta_2 = 1, \Delta_3 = 1$$

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40. ND

$$q(x, y, z) = -9x^2 + 6xy + 12xz - 2y^2 - 9z^2 \\ - (-3x + y + 2z)^2 - (y - 2z)^2 - z^2$$

$$\mathbf{A} = \begin{pmatrix} -9 & 3 & 6 \\ 3 & -2 & 0 \\ 6 & 0 & -9 \end{pmatrix}$$

$$p = L^3 + 20L^2 + 72L + 9$$

$$\bar{\lambda} = (-15.34663, -4.52373, -0.12964)$$

$$\Delta_1 = -9, \Delta_2 = 9, \Delta_3 = -9$$

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