Math 213 - Points in Space

Peter Perry

August 21, 2023

First-Day Information

Please read through the online syllabus! The online calendar tells all.

- Online Text
- Webwork (Always Log in from Canvas!)
- 10 Quizzes
- Three Midterm Exams
- One Final Exam
- Class Participation

My Office Hours: MWF 2:00-3:00, 755 POT

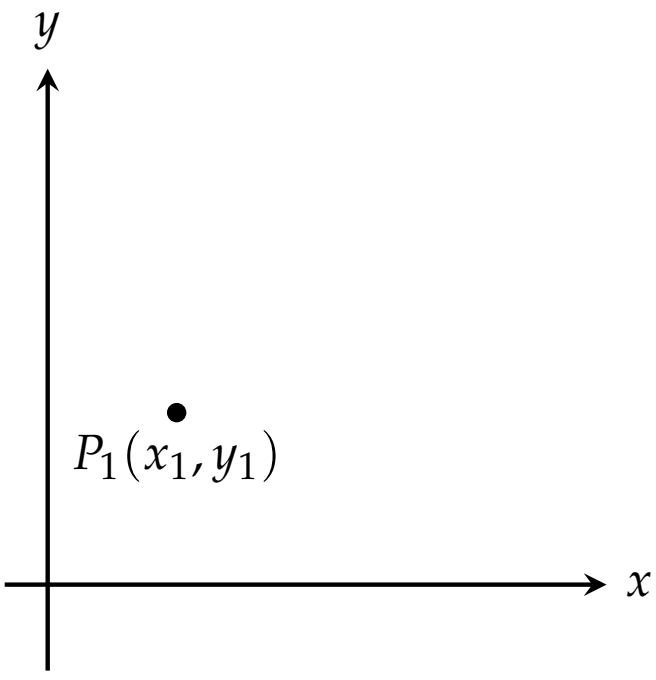
My E-Mail: `pperr0@uky.edu`

In an urgent situation: (859) 361-7725

Unit A: Vectors, Curves, and Surfaces

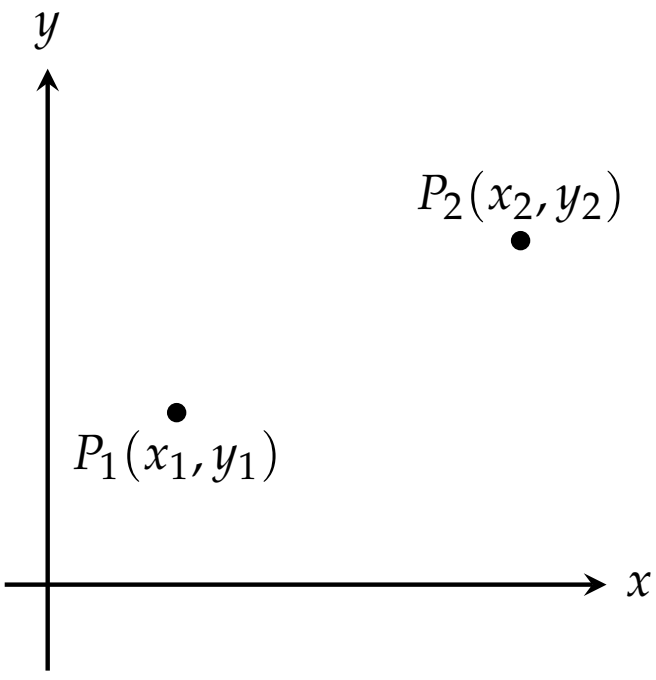
- August 21 - Points
- August 23 - Vectors
- August 25 - Dot Product
- August 28 - Cross Product
- August 30 - Equations of Planes
- September 1 - Equations of Lines
- September 6 - Curves
- September 8 - Integrating Along Curves
- September 11 - Integrating Along Curves
- September 13 - Sketching Surfaces
- September 15 - Cylinders and Quadric Surfaces

Points in the Plane



Points in the xy plane are described by two coordinates

Points in the Plane



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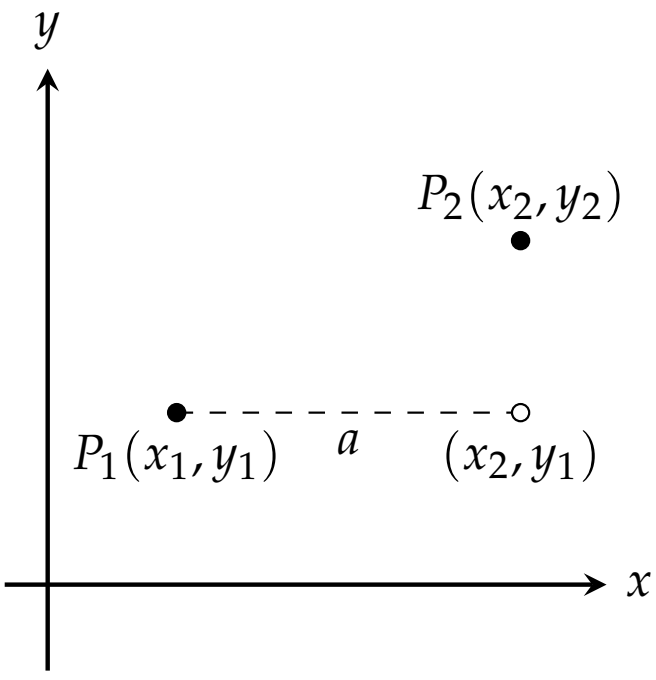

Points in the xy plane are described by two coordinates

The distance between two points is given by the Pythagorean Theorem:

$$c^2 = a^2 + b^2$$

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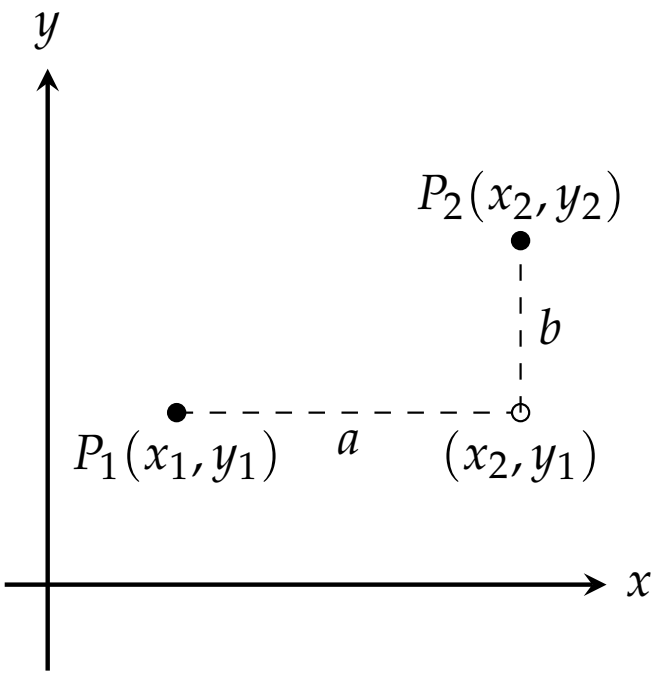

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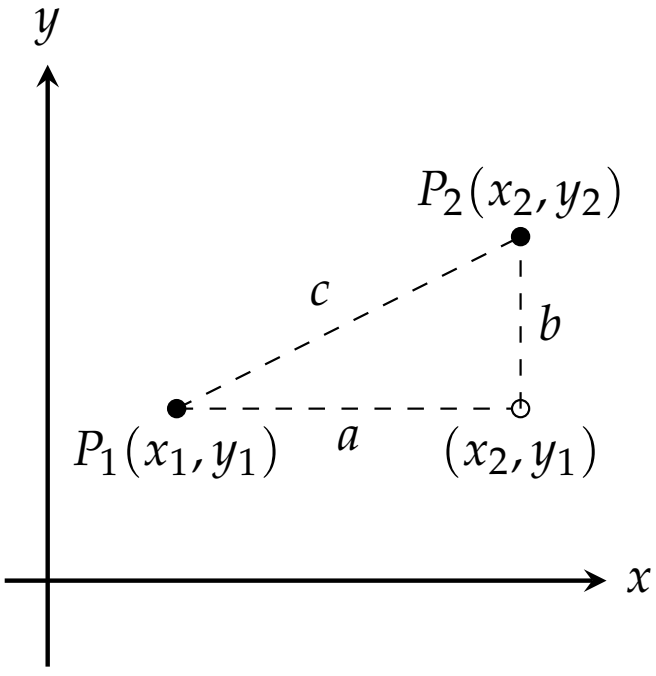

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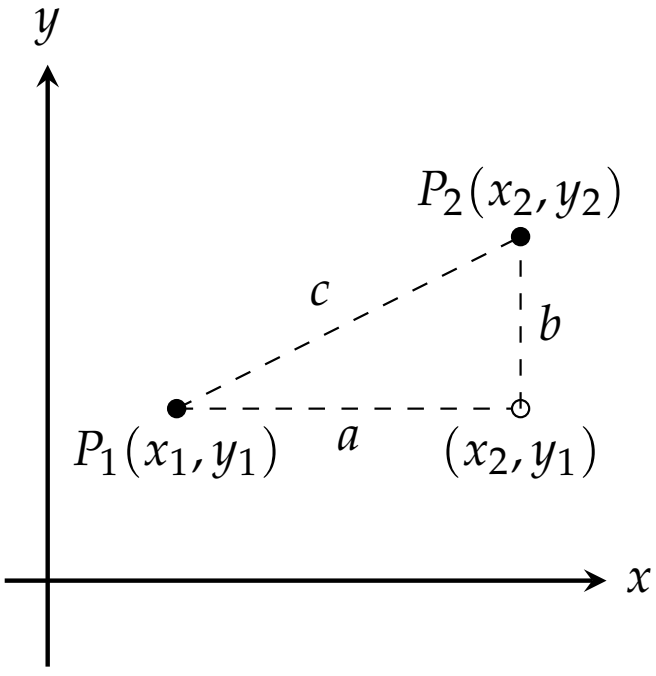

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$$a = x_2 - x_1$$

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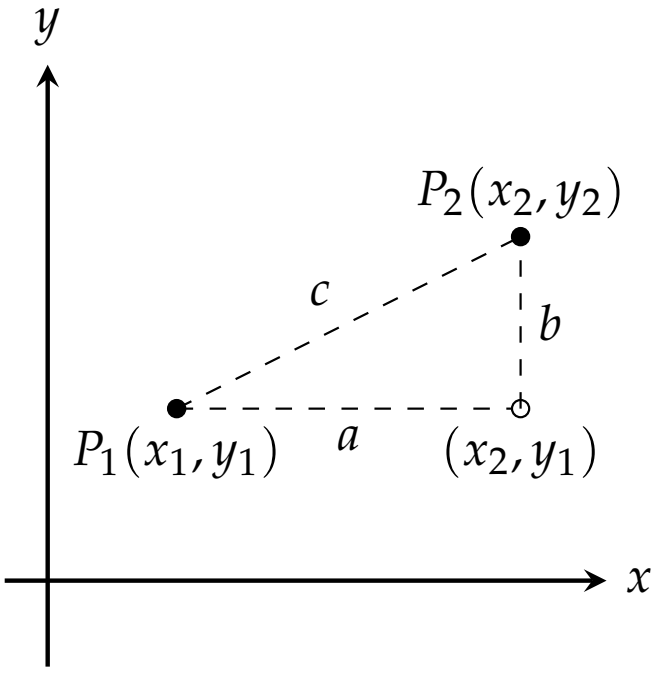

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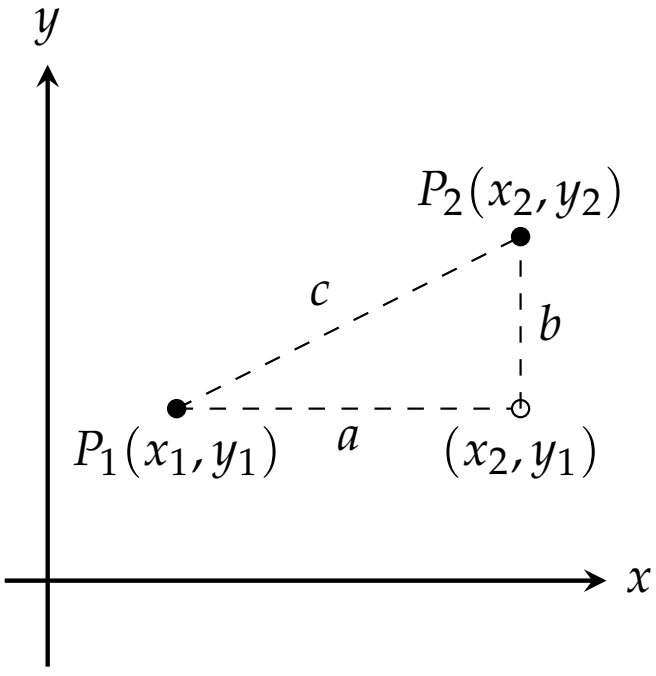

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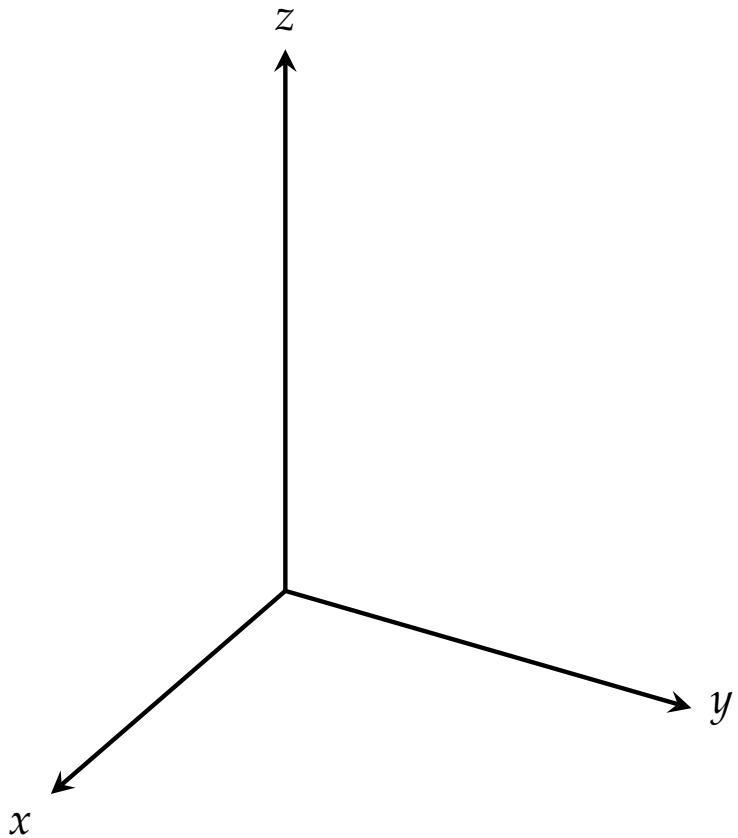
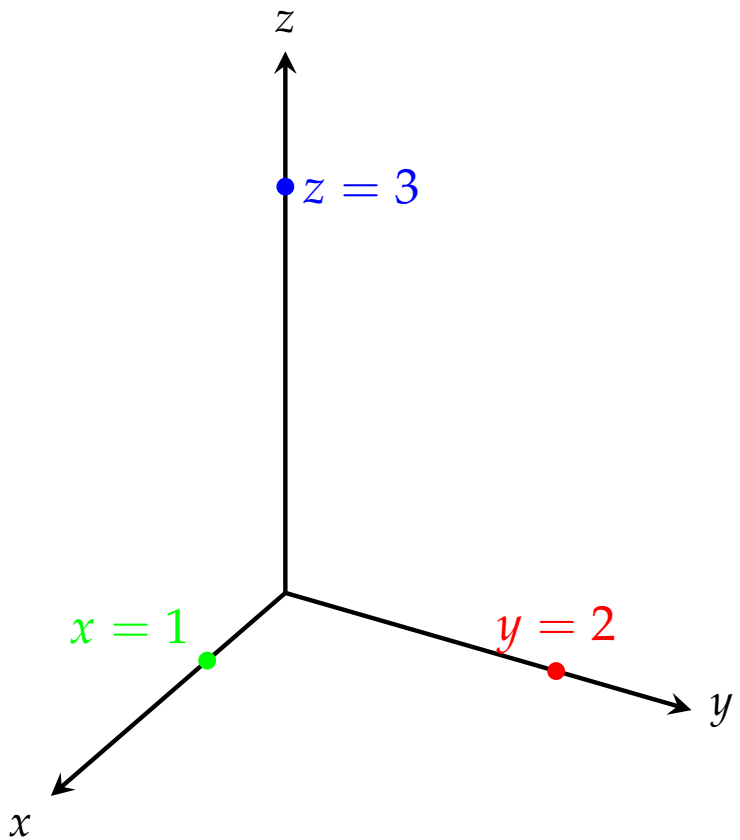
Points in Space



Points in space have (x, y, z) coordinates

Points in Space



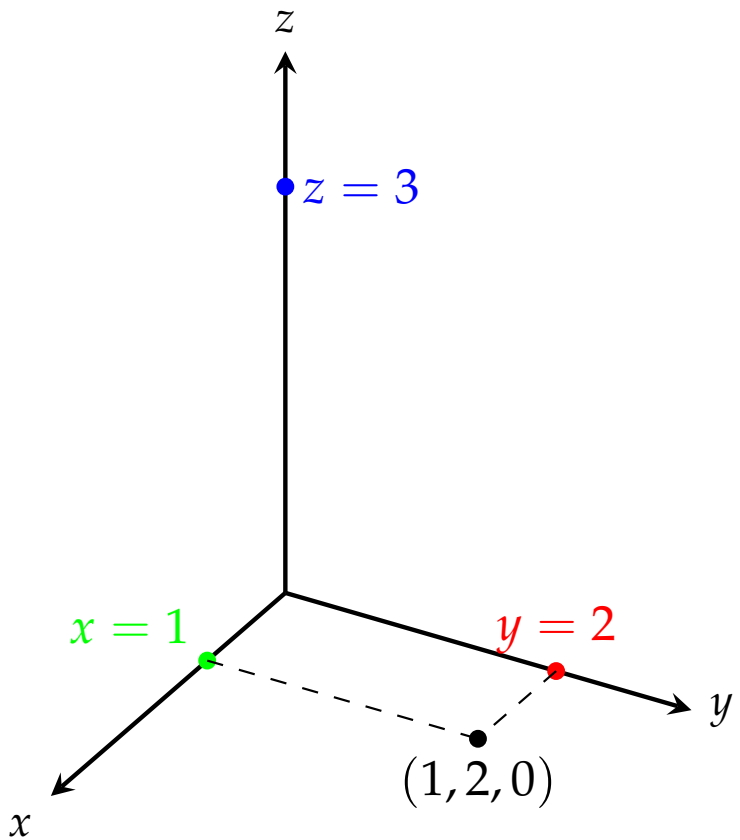
The point

$$P = (1, 2, 3)$$

is located as follows:

1. Locate the point $(1, 2)$ in the xy plane
2. Move up 3 units in the z direction

Points in Space



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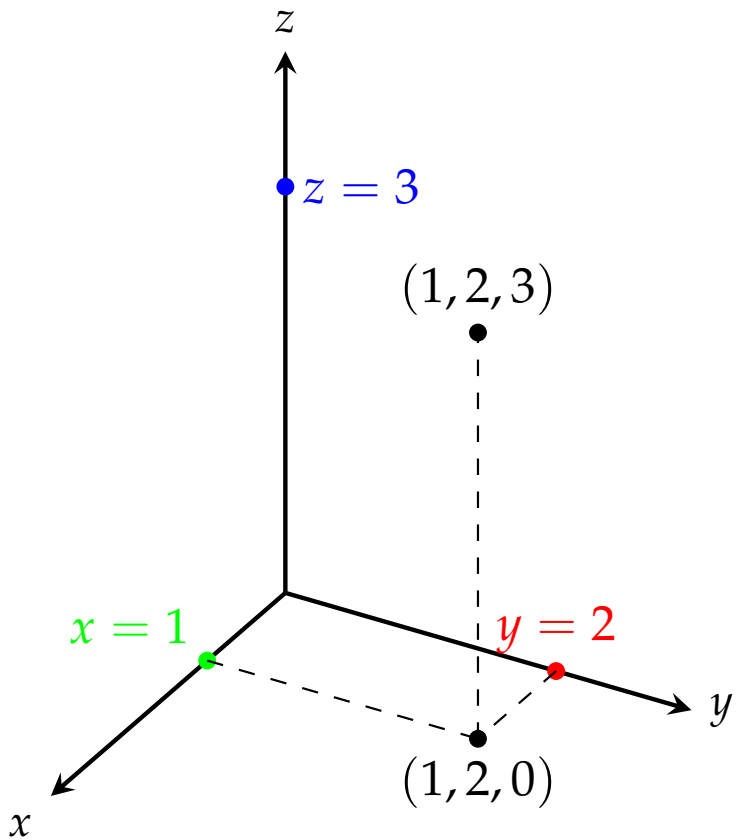

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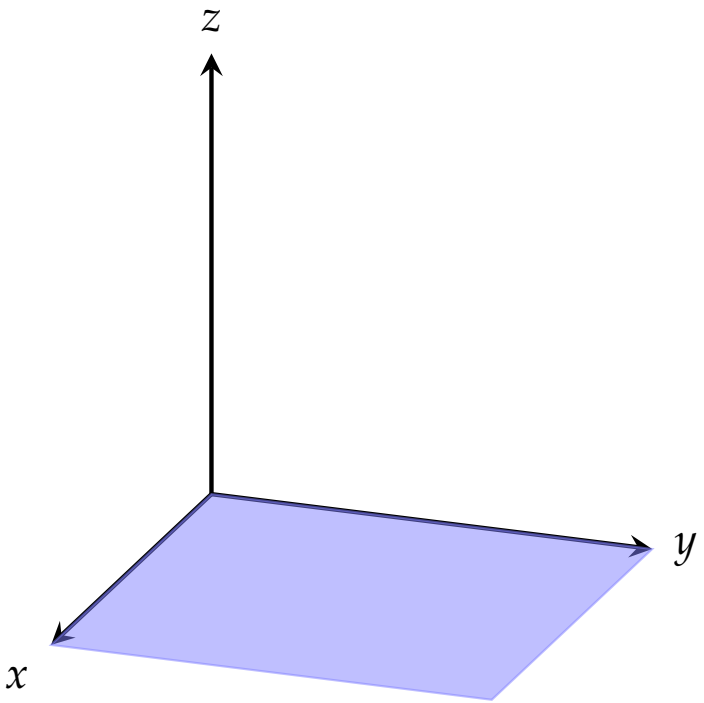
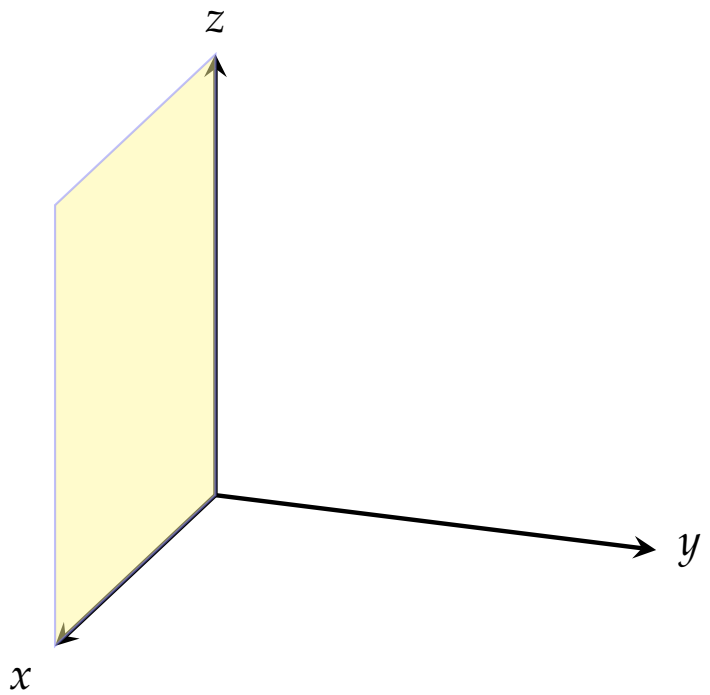


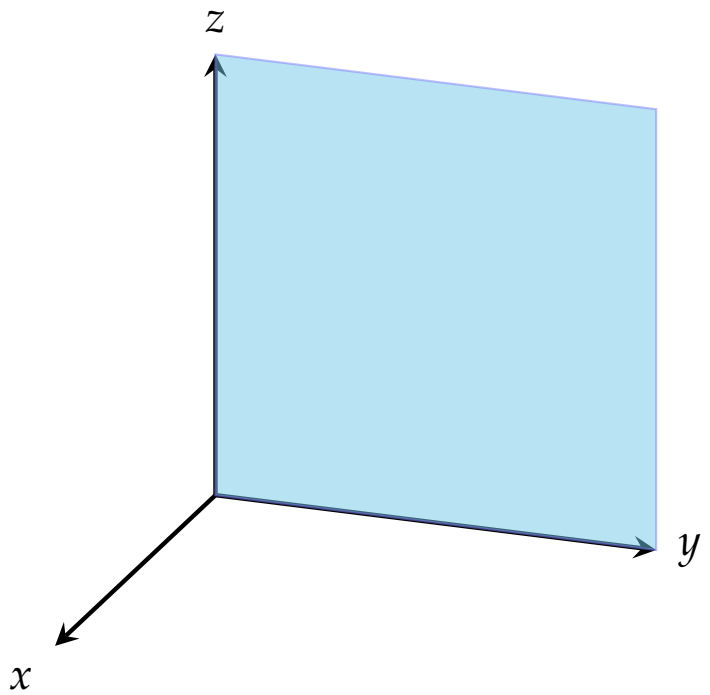
The xy plane is the plane with $z = 0$

Planes in Space



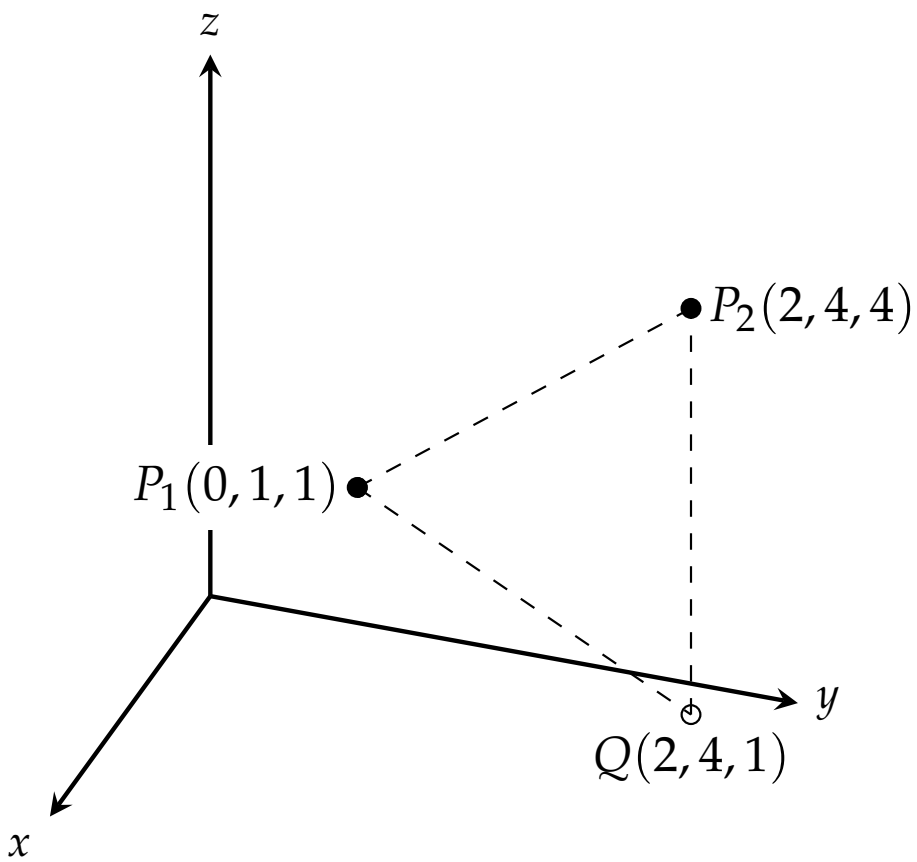
The xz plane is the plane with $y = 0$

Planes in Space



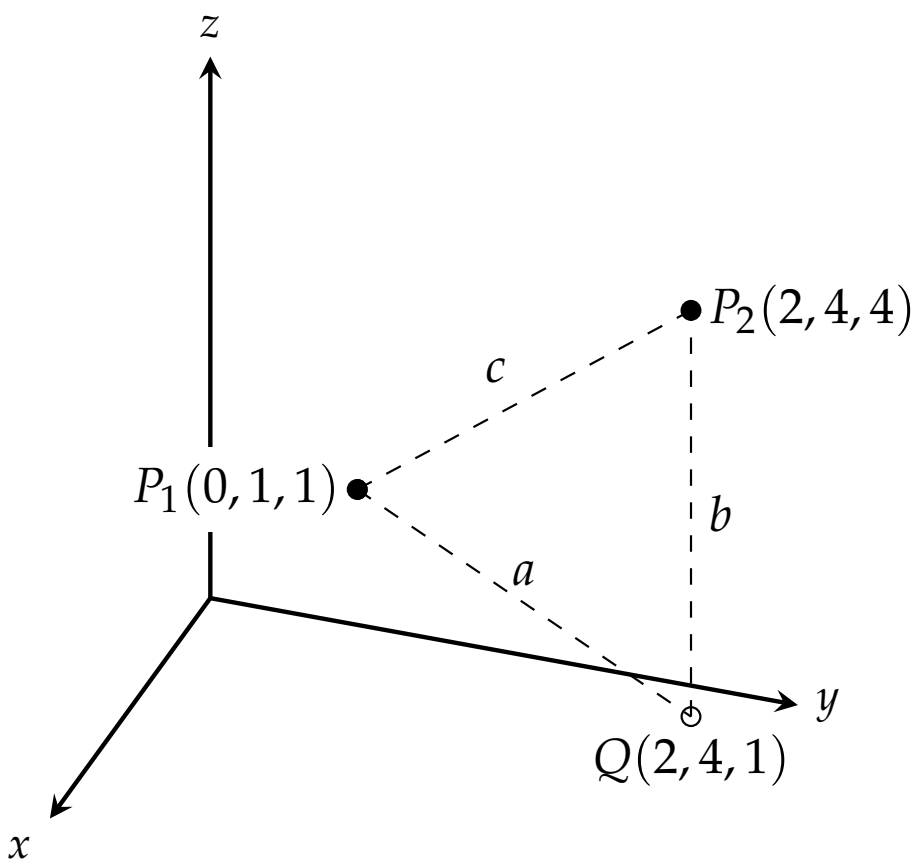
The yz plane is the plane with $x = 0$

Distances in Space



How do we find the distance from P_1 to P_2?

Distances in Space



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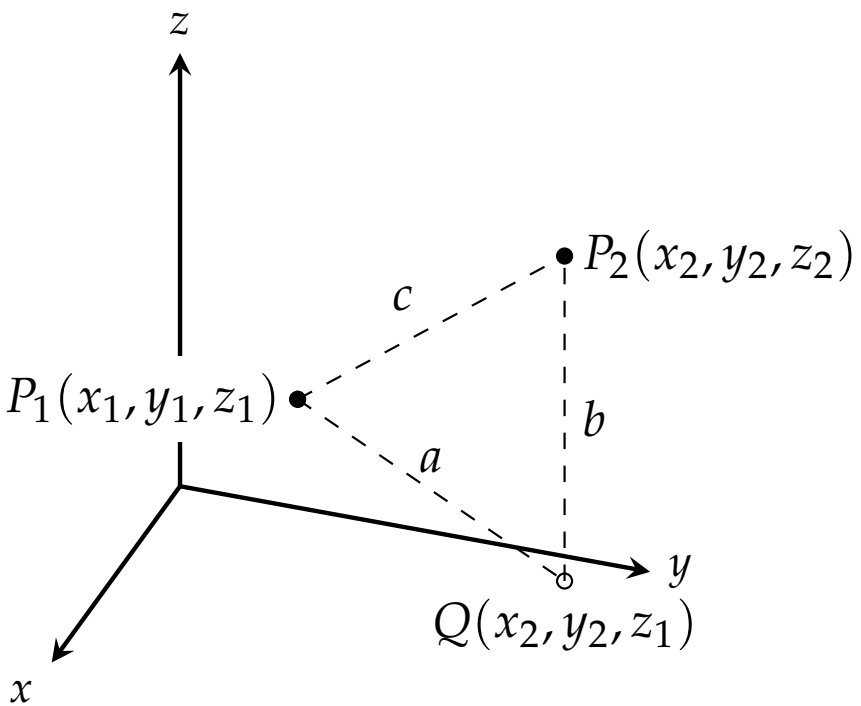
$$c^2 = a^2 + b^2$$

The Distance Formula



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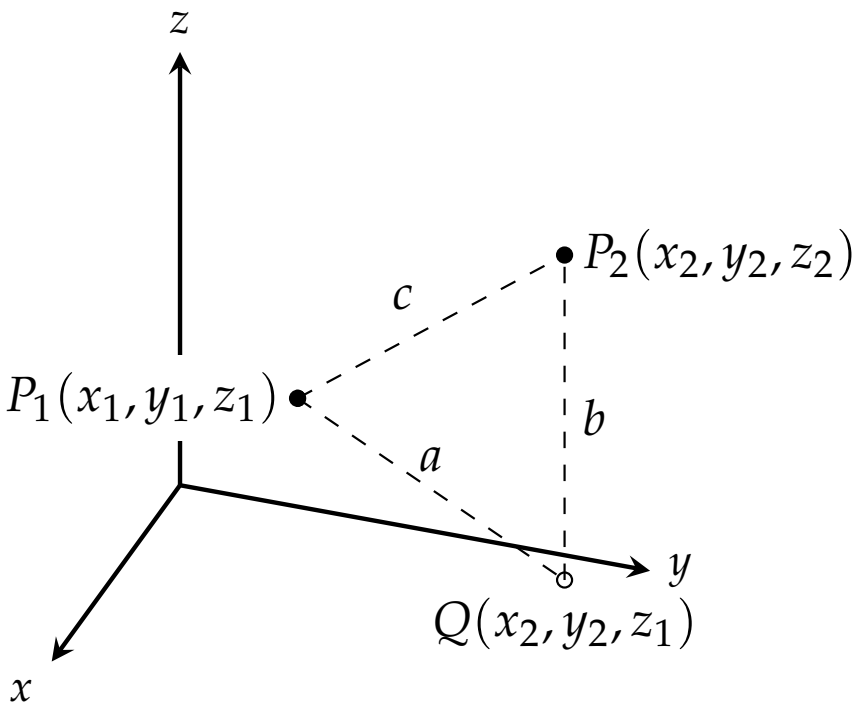

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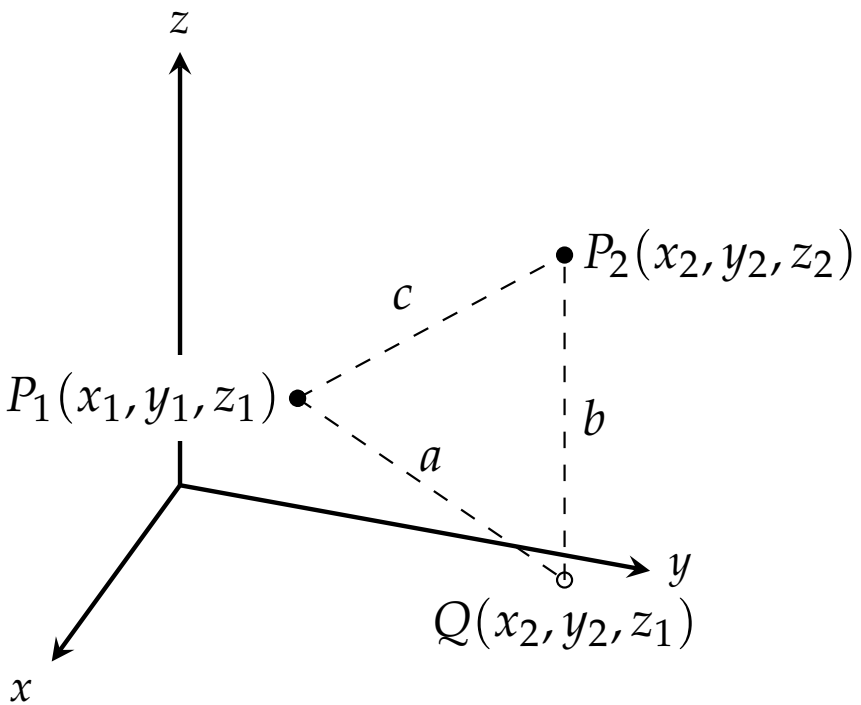
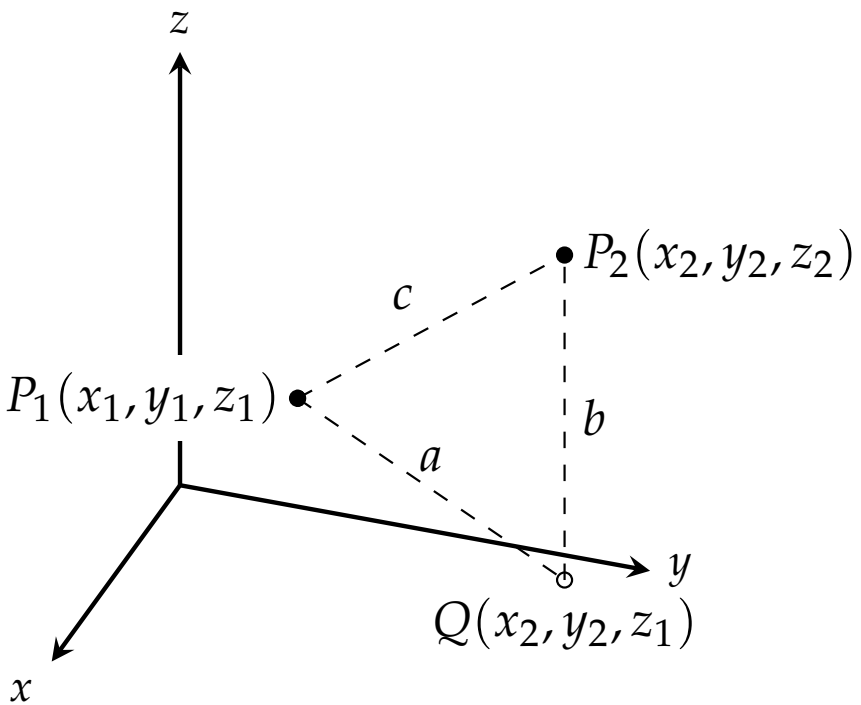


How do we find the distance from P_1 to P_2?

$$c^2 = a^2 + b^2$$

$$a^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$

The Distance Formula



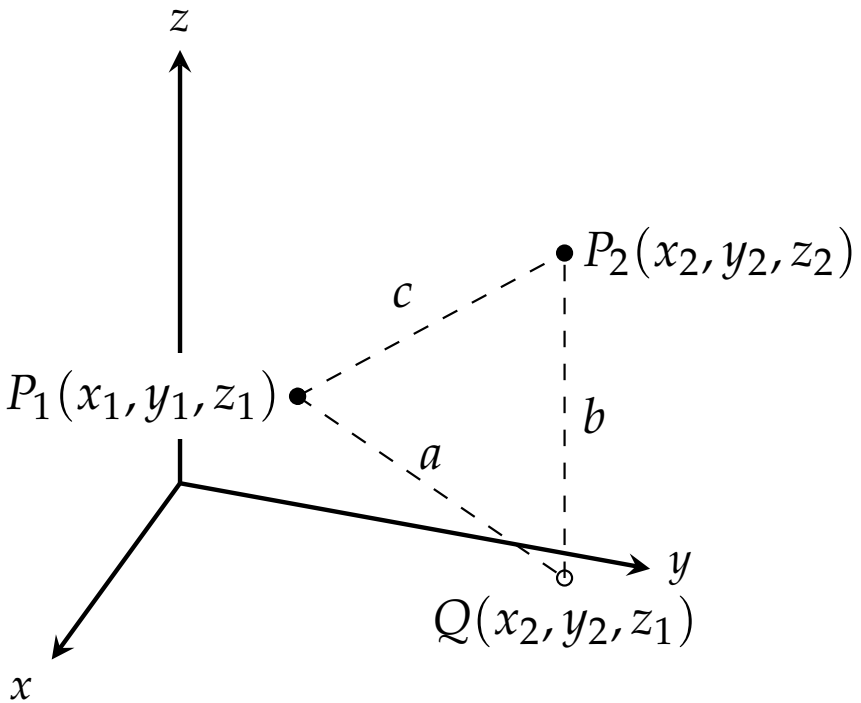
How do we find the distance from P_1 to P_2?

$$c^2 = a^2 + b^2$$

$$a^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$

$$b^2 = (z_2 - z_1)^2$$

The Distance Formula

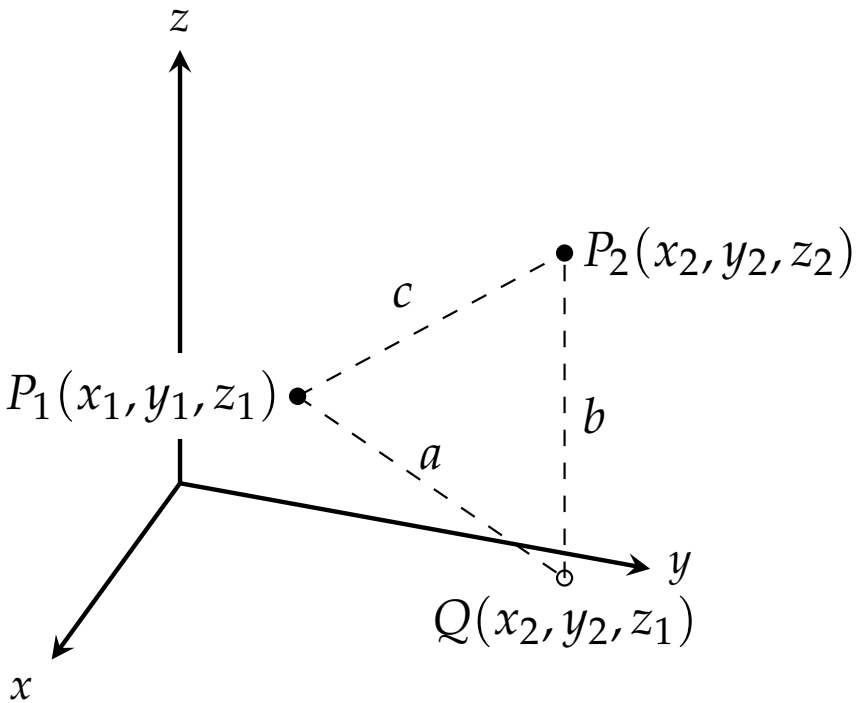


$$c^2 = a^2 + b^2$$

$$a^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$
$$b^2 = (z_2 - z_1)^2$$

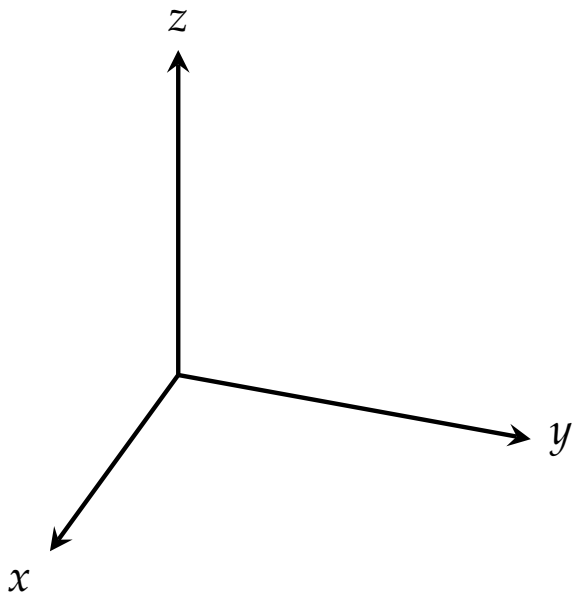
$$c^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2$$

The Distance Formula



$$d(P_1, P_2) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

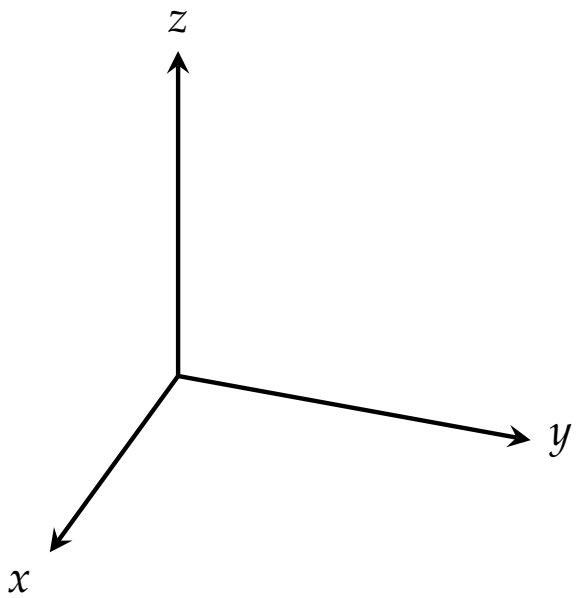
Puzzler #1



Find the set of points (x, y, z) that obey the equation

$$x^2 + y^2 + z^2 = 25$$

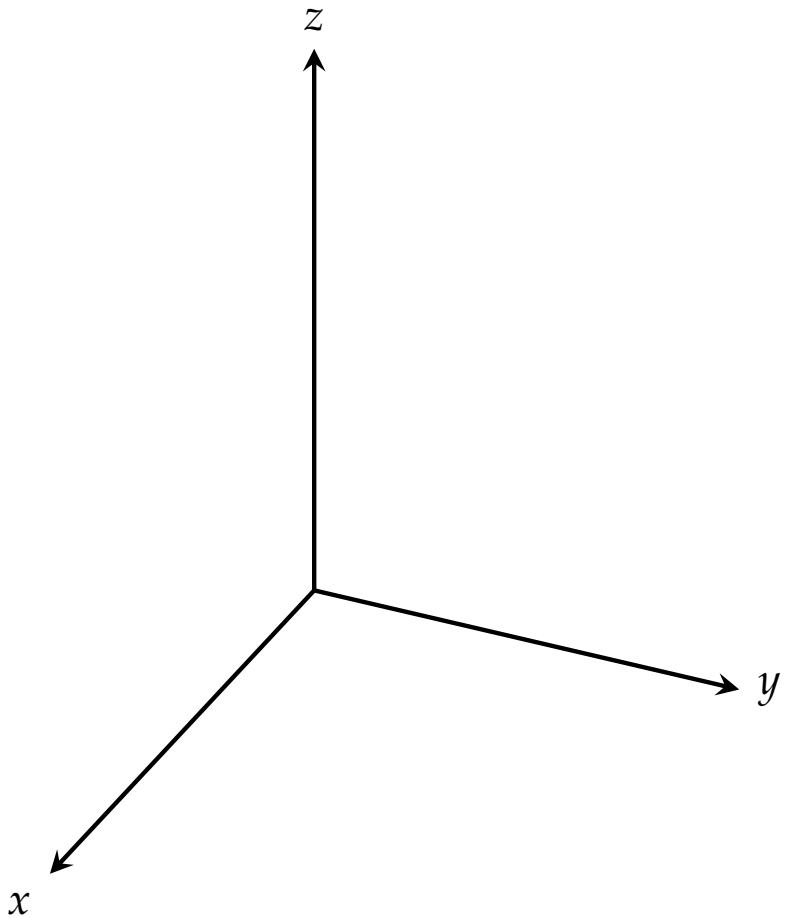
Puzzler #2



Find the set of points (x, y, z) that obey the equation

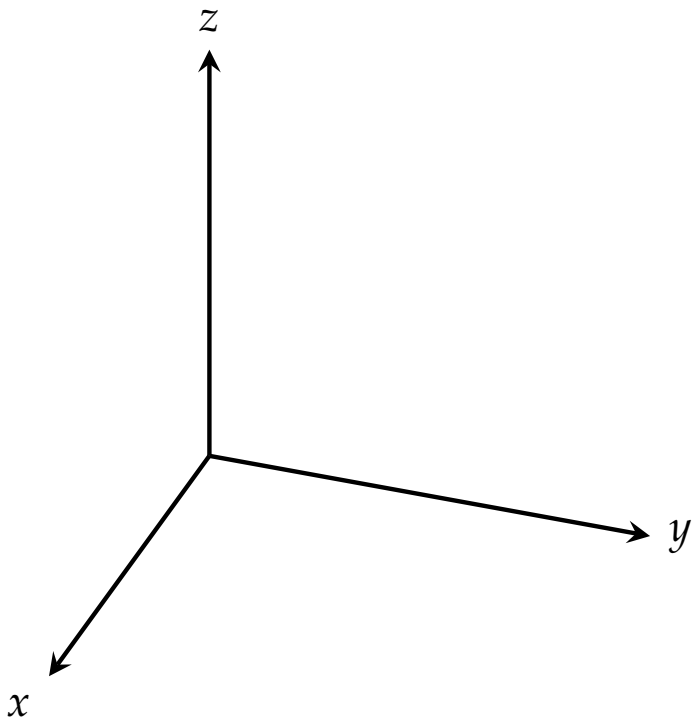
$$x^2 + y^2 + z^2 - 4x - 4y = 0$$

Puzzler #3



Find the set of points that obey the equation $x^2 + y^2 = 1$

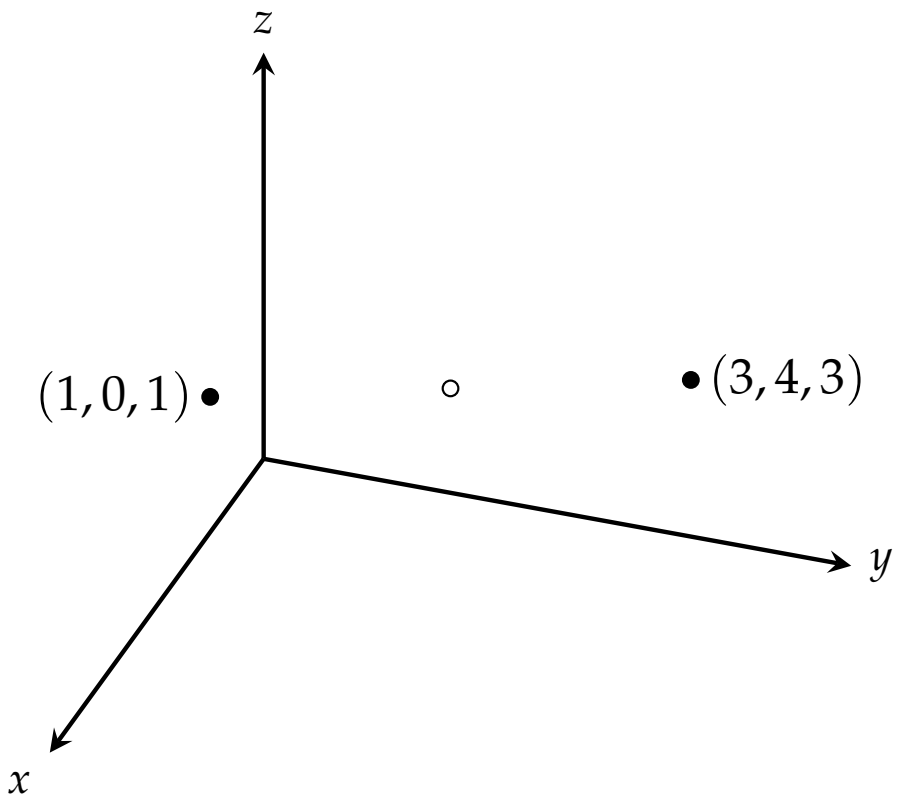
Puzzler #4



Find the set of points that satisfy the equation $x = y$

Puzzler # 5

Find the equation of a sphere if one of its diameters has endpoints $(1,0,1)$ and $(3,4,3)$.



Puzzler #6

Describe the set of points $(x, y, z) \in \mathbb{R}^3$ that obey the *inequality*

$$x^2 + y^2 + z^2 < 2x - 2y + 8$$

Extra-Credit Puzzler

Find the set of points that satisfy *both* of the equations

$$x^2 + y^2 + z^2 = 6$$
$$x^2 + y^2 = 2$$

Reminders for the Week of August 21-25

- Tuesday 8/22 - Recitation on CLP 3 1.1-Points
- Wednesday 8/23 - Read CLP3 1.2 on Vectors before class
- Thursday 8/24 - Recitation on CLP3 1.2-Vectors
- Friday 8/25 - Read CLP3 1.2 on Dot Products before class
- Friday 8/25 - Webwork A1 due at 11:59 PM