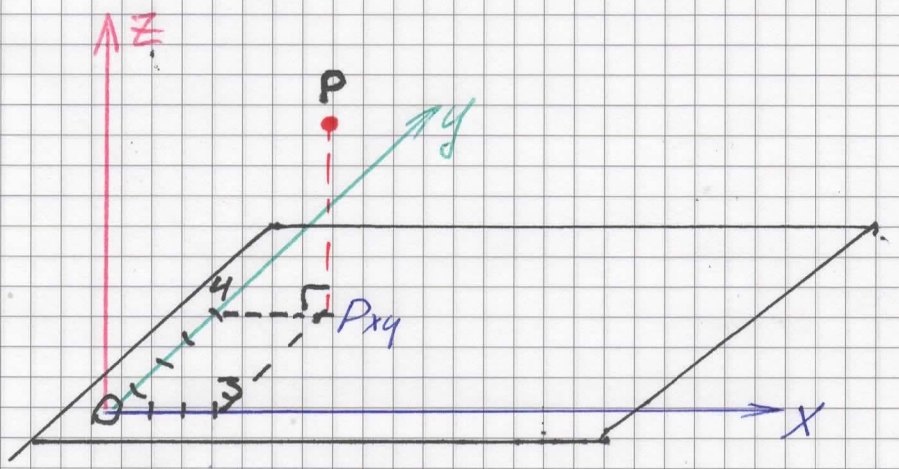
Igors Oleinikovs 93642

Introduction to vectors

1) Draw a right-handed coordinate system and locate the points:

a) P(3, 4, 5)

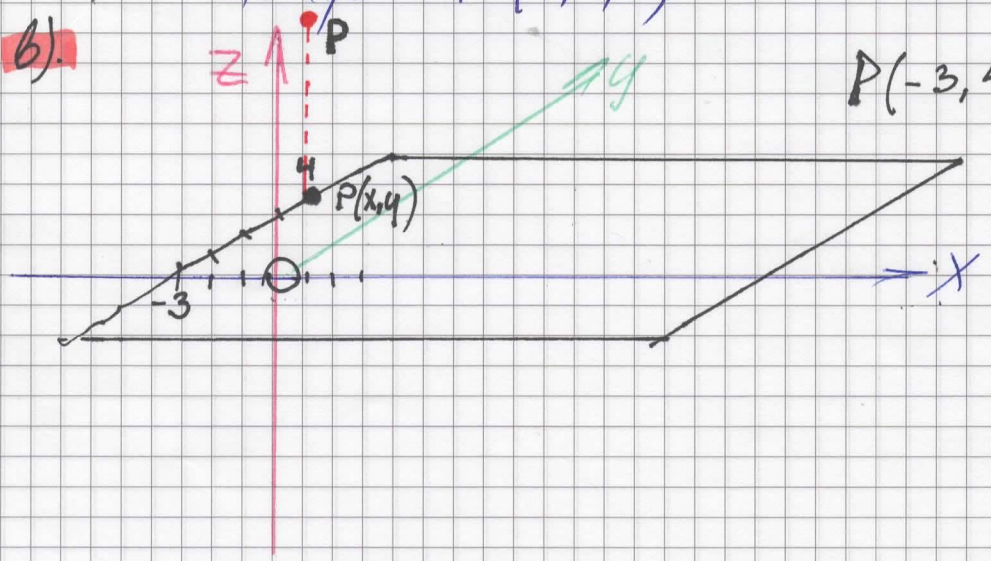
Draw a plane defined by xy-axis



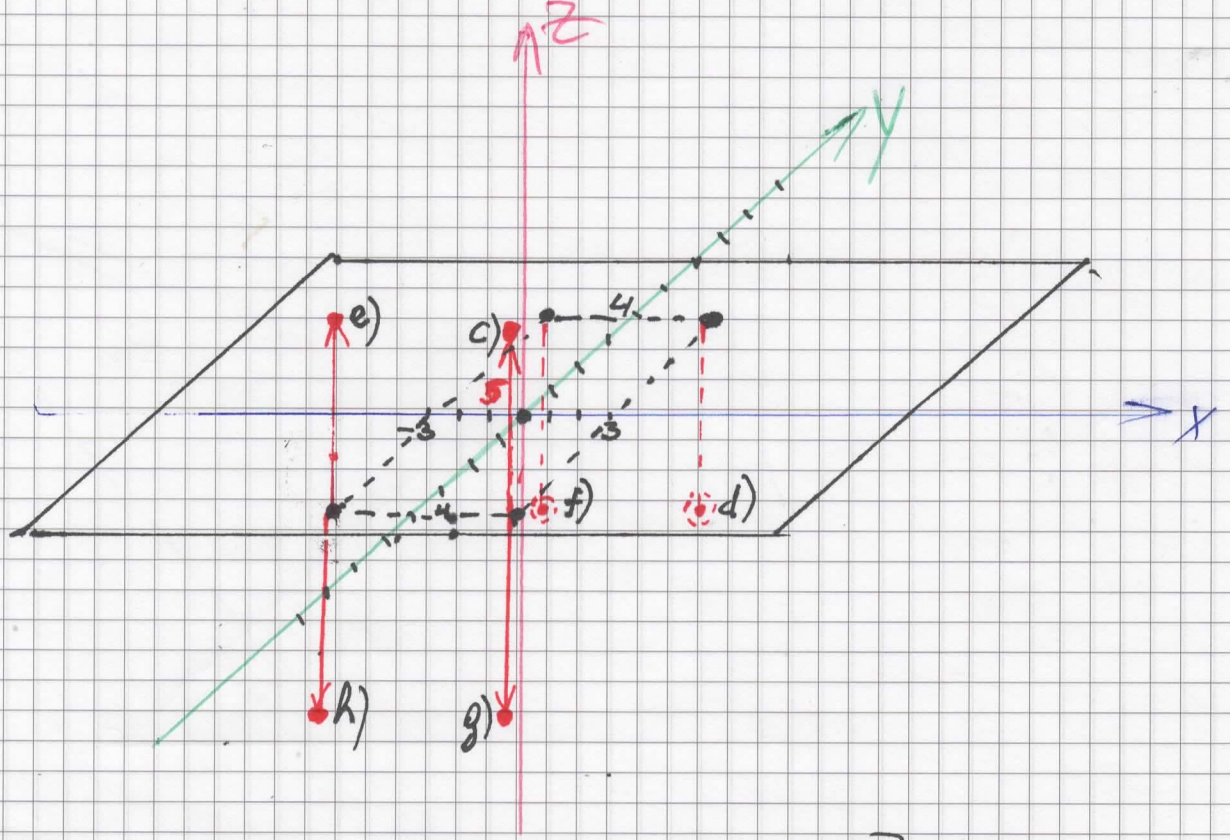
Locate P(x,y) = P(3,4) which is projection of P on plane xy.

Lift P(x,y) for 5 measurement units over the xy-plane under right angle (90°) to get P(3,4,5)

b)



c) (3, -4, 5) d) (3, 4, -5) e) (-3, -4, 5)
f) (-3, 4, -5) g) (3, -4, -5) h) (-3, -4, -5)



2. Find components of vector $\overrightarrow{P_1P_2}$

a) $P_1(4,8)$ $P_2(3,7)$

$P_1P_2 = (3-4, 7-8) = (-1; -1)$

$x = -1$; $y = -1$

b) $P_1(3; -5)$ $P_2(-4, -7)$

$\overrightarrow{P_1P_2} = (-4-3, -7-(-5)) = (-7, -2)$

$x = -7$; $y = -2$

c) $P_1(-5, 0)$ $P_2(-3, 1)$ $\overrightarrow{P_1P_2} = (-3-(-5), 1-0) = (2, 1)$

$x = 2$ $y = 1$

d) $P_1(3, -7, 2)$ $P_2(-2, 5, -4)$ $\overrightarrow{P_1P_2} = (-2-3, 5-(-7), -4-2)$
$= (-5, 12, -6)$

$x = -5$

$y = 12$

$z = -6$

e) $\overrightarrow{P_1}(-1,0,2)\ P_2(0,-1,0)$

$\overrightarrow{P_1P_2} = (0-(-1), -1-0, 0-2) = (1,-1,-2)$

$x=1 \quad y=-1 \quad z=-2$

(3) Let $u=(-3,1,2)\ v=(4,0,-8)\ w=(6,-1,-4)$

Find components

a) $v-w = (4,0,-8)-(6,-1,-4)$

$x=4-6=-2 \quad y=0-(-1)=1 \quad z=-8-(-4)=-4$

b) $6u+2v = 6\cdot(-3,1,2)+2\cdot(4,0,-8) = (-18,6,12) + (8,0,-16) = (-10,6,-4)$

$x=-10 \quad y=6 \quad z=-4$

c) $-v+u = -(4,0,-8)+(-3,1,2) = (-4,0,8)+(-3,1,2) = (-7,1,10)$

$x=-7 \quad y=1 \quad z=10$

d) $5\cdot(v-4u) = 5\cdot((4,0,-8)-4\cdot(-3,1,2)) = 5\cdot((4,0,-8)-(-12,4,8)) = 5\cdot(16,-4,-16) = (80,-20,-80)$

$x=80 \quad y=-20 \quad z=-80$

e) $-3(v-8w) = -3((4,0,-8)-8\cdot(6,-1,-4)) = -3\cdot(-44,8,24) = (132,-24,-72)$

$x=132 \quad y=-24 \quad z=-72$

(4) Find the norm of v

a) $v(4,-3) \quad |v| = \sqrt{4^2+(-3)^2} = \sqrt{16+9} = \sqrt{25} = 5$

b) $v(2,3) \quad |v| = \sqrt{4+9} = \sqrt{13} \approx 3,6$

c) $v(2,2,2) \quad |v| = \sqrt{4+4+4} = \sqrt{12} \approx 3,46$

d) $v(-7, 2, -1)$

$$|v| = \sqrt{49+4+1} = \sqrt{54} \approx 7,35$$

e) $v(2, 6, 1)$

$$|v| = \sqrt{4+36+1} = \sqrt{41} \approx 6,4$$

5. Find the distance between P_1 and P_2

a) $P_1(-3, 6)$ $P_2(-1, -4)$

$$\text{Distance} = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2} =$$

$$= \sqrt{2^2+(-10)^2} = \sqrt{104} \approx 10,2$$

b) $P_1(7, -5, 1)$ $P_2(-7, -2, -1)$

$$\text{Distance} = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2+(z_2-z_1)^2} =$$

$$= \sqrt{(-14)^2+3^2+(-2)^2} =$$

$$= \sqrt{196+9+4} = \sqrt{209} \approx 14,46$$

c) $P_1(3, 3, 3)$ $P_2(6, 0, 3)$

$$\text{Dist.} = \sqrt{3^2+(-3)^2+0^2} = \sqrt{18} \approx 4,24$$