12.1 #1-18 all

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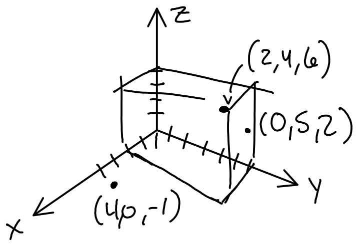
8:12 PM

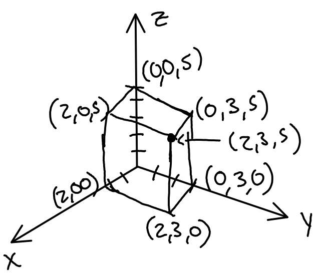
① $(4,0,-3)$

②

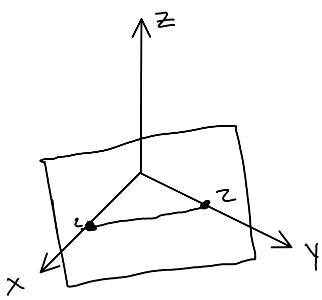


③ Q, R

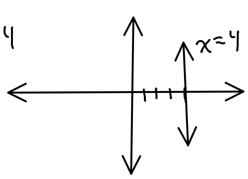
④



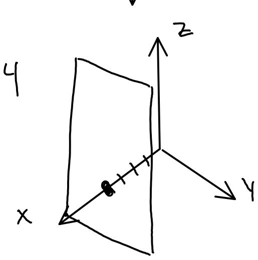
⑤



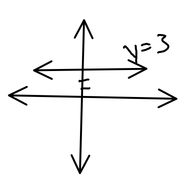
⑥ⓐ $\mathbb{R}^2$ $x=4$



$\mathbb{R}^3$ $x=4$

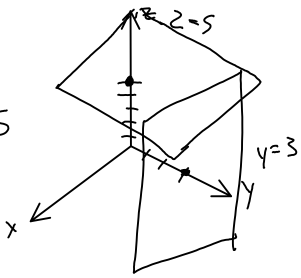


ⓑ $y=3$ $\mathbb{R}^2$



$\mathbb{R}^3$

$\mathbb{R}^3$ $y=3$
$z=5$



⑦ $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2+(z_2-z_1)^2}$
$P(-2,4,0)$ $Q(1,2,-1)$ $R(-1,1,2)$

$\overline{PQ}$ $\sqrt{(-3)^2+(2)^2+(1)^2}$
$\overline{PQ}=\sqrt{14}$

$\overline{QR}=\sqrt{(2)^2+(1)^2+(3)^2}$
$=\sqrt{14}$

$\overline{PR}=\sqrt{(-1)^2+(3)^2+(-2)^2}$
$=\sqrt{14}$

$\overline{PQ}=\overline{PR}=\overline{QR}$ therefore points P, Q and R form equilateral triangle

⑧ $\overline{AB}=\sqrt{(-2)^2+(-2)^2+(-1)^2}$
$=3$
$\overline{AC}=\sqrt{(-2)^2+(4)^2+(-4)^2}$
$=6$
$\overline{BC}=\sqrt{(0)^2+(6)^2+(3)^2}$
$=\sqrt{45}$

$3^2+6^2 \overset{?}{=} 45$
yes, $\boxed{\text{right triangle}}$

⑨ ⓐ yes ⓑ no

⑩ $(3,7,-5)$
ⓐ $(0,0,-5)$ $D=\sqrt{(3)^2+(7)^2+(0)^2}$
$=\sqrt{58}$
ⓑ $(3,0,0)$ $D=\sqrt{(0)^2+(7)^2+(-5)^2}$
$=\sqrt{74}$
ⓒ $(0,7,0)$ $D=\sqrt{(3)^2+(0)^2+(-5)^2}$
$=\sqrt{34}$
ⓓ $(0,7,-5)$ $D=\sqrt{(3)^2}=3$

ⓔ $(3,0,-5)$ $D = 7$

ⓕ $(3,7,0)$ $D = 5$

⑪ $(x-1)^2 + (y+4)^2 + (z-3)^2 = 25$

xz plane $\quad (x-1)^2 + (0+4)^2 + (z-3)^2 = 25$

$(x-1)^2 + (z-3)^2 = 9 \leftarrow$ circle

⑫ $(x-6)^2 + (y-5)^2 + (z+2)^2 = 7$

xz plane when $y=0$

$(x-6)^2 + (z+2)^2 = 18$

zy plane $\quad (y-5)^2 + (z+2)^2 = 29$

xy plane $\quad (x-6)^2 + (y-5)^2 = 3$

x plane $\quad (x-6)^2 = 22$

y plane $\quad (y-5)^2 = 33$

z plane $\quad (z+2)^2 = 54$

⑬ $D = \sqrt{(1)^2 + (5)^2 + (-2)^2} = \sqrt{30}$

$(x-3)^2 + (x-8)^2 + (x-1)^2 = 30$

⑭ $D = \sqrt{(1)^2 + (2)^2 + (3)^2} = \sqrt{14}$

$(x-1)^2 + (y-2)^2 + (z-3)^2 = 14$

⑮ $x^2 + y^2 + z^2 - 6x + 4y - 2z = 11$

$x^2 - 6x + (3)^2 - (3)^2 + y^2 + 4y + (2)^2 - (2)^2 + z^2 - 2z + (1)^2 - (1)^2 = 11$

$(x-3)^2 + (y+2)^2 + (z-1)^2 = 11 + 1 + 4 + 9$

$(x-3)^2 + (y+2)^2 + (z-1)^2 = 25$

center: $(3,-2,1)$ radius $= 5$

⑯ $x^2 - 4x + y^2 + 2y + z^2 = 0$

$x^2 - 4x + (2)^2 - (2)^2 + y^2 + 2y + (1)^2 - (1)^2 + z^2 = 0$

$(x-2)^2 + (y+1)^2 + z^2 = 5$

center $(2,-1,0)$ radius: $\sqrt{5}$

⑰ $x^2 - x + y^2 - x + z^2 - z = 0$

$x^2 - x + (\frac{1}{2})^2 - (\frac{1}{2})^2 + y^2 - y + (\frac{1}{2})^2 - (\frac{1}{2})^2 + z^2 - z + (\frac{1}{2})^2 - (\frac{1}{2})^2 = 0$

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

center $(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$ radius $= \frac{\sqrt{3}}{2}$

(18) $4x^2 - 8x + 4y^2 + 16y + 4z^2 = 1$

$x^2 - 2x + (1)^2 - (1)^2 + y^2 + 4y + (2)^2 - (2)^2 + z^2 = \frac{1}{4}$

$(x-1)^2 + (y+2)^2 + z^2 = \frac{1}{4} + 1 + 4 = \frac{21}{4}$

$\boxed{\text{center: } (1,-2,0) \quad \text{radius: } \frac{\sqrt{21}}{2}}$