

ray origin eye pt (0,0,0)
dir (x₃₀, y₃₀, z₃₀)

$$\text{len} = \sqrt{x_{30}^2 + y_{30}^2 + z_{30}^2}$$

$$\text{normalized} \left(\frac{x_{30}}{\text{len}}, \frac{y_{30}}{\text{len}}, \frac{z_{30}}{\text{len}} \right)$$

```
typedef struct {
    VP_T origin;
    VP_T dir;
} RAY_T;
```

VP_T

main

```
init sphere ctr (0,0,10) r = 2;
sphere color (1,0,0)
light loc (5,0,0)
```

→ DPM

```
for y
for x
```

set ray origin
dir

if intersect_sphere

printf ("%c%c%c", (unsigned char)(R * 255)

else

printf (<black>

P6

1000 1000

255

RGBRGBRGB...

intersect_sphere (ray, sphere, *t, *int_pt, *normal)
| ctr radius

$$A = 1$$

$$B = 2 * (dir_x * (or_x - ctr_x) + dir_y * (or_y - ctr_y) + dir_z * (or_z - ctr_z))$$

$$C = (or_x - ctr_x)^2 + (or_y - ctr_y)^2 + (or_z - ctr_z)^2 - r^2$$

$$t_1, t_2 = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$$

if discrim <= 0
no intersection

$$\text{int_pt} = \text{or} + t * \text{dir}$$

$$\text{norm} = \text{int_pt} - \text{ctr}$$

