$\Rightarrow$ [AC] is the diameter of the circle circumscribed about $\triangle ABC$

So radius $= \frac{AC}{2}$.

But, $AC^2 = AB^2 + BC^2$ (Pythagourus theorem)

$AC^2 = (4+\sqrt{7})(4+\sqrt{7})$

$AC^2 = 8 + 2\sqrt{7}$

& but $8 + 2\sqrt{7} = (\sqrt{7}+1)^2$

$\Rightarrow AC^2 = (\sqrt{7}+1)^2$

$\Rightarrow AC = \sqrt{7}+1$

$\therefore \boxed{r = \frac{\sqrt{7}+1}{2}}$.

3rd exercise:

1) 1 is a root for $P(x)$

$\Rightarrow P(1) = 0$

$\Rightarrow 3(1)^3 - 12(1)^2 - 3(1) + a = 0$

$3 - 12 - 3 + a = 0$

$\therefore \boxed{a = 12}$

2) $P(x) = 3x^3 - 12x^2 - 3x + 12$

$= 3x(x^2-1) - 12(x^2-1)$

$= (x^2-1)(3x-12)$

$\therefore P(x) = 3(x-1)(x+1)(x-4)$.

Now, $P(x) = 0$

$\Rightarrow 3(x-1)(x+1)(x-4) = 0$

So, $x-1 = 0 \Rightarrow x = 1$

or $x+1 = 0 \Rightarrow x = -1$

or $x-4 = 0 \Rightarrow x = 4$