Question 8 (4 marks)

In the following simultaneous equations, a and b are real numbers.

$$a^3 = 3ab^2 + 14$$
$$b^3 = 3a^2b + 2\sqrt{5}$$

In order to determine the value of $a^2 + b^2$ from these equations, it is useful to consider the complex expansion for $(a + bi)^3$. Hence, or otherwise, determine the exact value of $a^2 + b^2$.