3. (a) Construct an equilateral triangle and bisect any of its angles.
(b) Construct a right angle and bisect it.
(c) The 30° angle trisects a 90° angle. Bisecting the 30° angle gives a trisection of a 45° angle.

5.
\[
\cos 3t = \cos(2t + t) = \cos(2t)\cos(t) - \sin(2t)\sin t \\
= (2\cos^2 t - 1)\cos t - 2\sin^2 t\cos t \\
= 2\cos^3 t - \cos t - 2(1 - \cos^2 t)\cos t \\
= 4\cos^3 t - 3\cos t.
\]

6. If \( \cos 3t = \frac{1}{3} \), we get \( \frac{1}{3} = 4\cos^3 t - 3\cos t \), or \( 12\cos^3 t - 9\cos t - 1 = 0 \). Thus, \( \cos t \) is a root of \( 12x^3 - 9x - 1 \). By the rational root test, this is irreducible, so it has no rational roots. Theorem 15.9 implies that this polynomial has no constructible numbers as roots, so \( \cos t \) is not constructible.

If \( \cos 3t = \frac{11}{16} \), we get \( \frac{11}{16} = 4\cos^3 t - 3\cos t \), or \( 64\cos^3 t - 48\cos t - 11 = 0 \). Thus, \( \cos t \) is a root of \( 64x^3 - 48x - 11 \). This is \( (4x + 1)(16x^2 - 4x - 11) \), so \( \cos t \) is a root of \( 16x^2 - 4x - 11 \). Since the roots of \( 16x^2 - 4x - 11 \) lie in a quadratic extension of \( \mathbb{Q} \), \( \cos t \) is constructible.

8. Construct a unit segment, then construct a segment of length 2. Construct an equilateral triangle of side length 2. Bisect one of its angles. The length of the segment from the bisected angle to the opposite side is \( \sqrt{3} \). Add 1 to this.

9. Let \( b \) be the length of the base, and let \( s \) be the length of the sides. Then \( b + 2s = 8 \) and \( \frac{1}{2}b\sqrt{s^2 - \frac{b^2}{4}} = 1 \).

Substituting \( b = 8 - 2s \) gives \( (4 - s)\sqrt{s^2 - \frac{(8 - 2s)^2}{4}} = 1 \), or \( (4 - s)\sqrt{\frac{4s^2 - 64 + 32s - 4s^2}{4}} = (4 - s)\sqrt{8s - 16} = 1 \). Squaring both sides gives

\[
64(s^2 - 8s + 16)(s - 2) = 1 \\
64s^3 - 640s^2 + 320s - 2049 = 0.
\]

Let \( t = 4s \). Then the above polynomial is \( p(t) = t^3 - 40t^2 + 80t - 2049 \), which is irreducible if and only if the original polynomial is irreducible. 2049 = 3(683), so the Rational Root Test implies that only \( \pm 1, \pm 3, \pm 683, \) and \( \pm 2049 \) are possible rational roots of \( p(t) \). Since none of these is a root, \( p(t) \) is irreducible over \( \mathbb{Q} \), and therefore has no constructible numbers as roots. Thus, the side length \( s \) is not constructible.