What is claimed is:

1. A B-cell maturation antigen (BCMA)-specific chimeric antigen receptor comprising, from N-terminus to C-terminus:

(a) an extracellular ligand-binding domain comprising an anti-BCMA antigen-binding domain;

(b) a hinge;

(c) a transmembrane domain; and

(d) a cytoplasmic domain comprising a costimulatory domain and a signaling domain;

wherein the anti-BCMA antigen-binding domain is an anti-BCMA single chain variable fragment (scFv) domain comprising a light chain variable region (LCVR) and a heavy chain variable region (HCVR) joined by a linker,

wherein the LCVR comprises light chain complementarity determining regions, LCDR1-LCDR2-LCDR3, set out in SEQ ID NOs: 60-62-64, respectively, and the HCVR comprises heavy chain complementarity determining regions, HCDR1-HCDR2-HCDR3, set out in SEQ ID NOs: 52-54-56, respectively.

2. The chimeric antigen receptor of claim 1, wherein the linker comprises an amino acid sequence selected from the group consisting of SEQ ID NOs: 93-96.

3. The chimeric antigen receptor of claim 1 or 2, wherein the LCVR comprises the amino acid sequence of SEQ ID NO: 58 and the HCVR comprises the amino acid sequence of SEQ ID NO: 50.

4. The chimeric antigen receptor of any one of claims 1-3:

(a) wherein the hinge, the transmembrane domain, or both, are from a CD8α polypeptide;

(b) wherein the costimulatory domain comprises a 4-1BB costimulatory domain; and/or

(c) wherein the signaling domain comprises a CD3zeta signaling domain.

5. The chimeric antigen receptor of any one of claims 1-4, wherein:

(a) the hinge comprises the amino acid sequence of SEQ ID NO: 97;

(b) the transmembrane domain comprises the amino acid sequence of SEQ ID NO: 98;

(c) the costimulatory domain comprises the amino acid sequence of SEQ ID NO: 99; or

(d) the signaling domain comprises the amino acid sequence of SEQ ID NO: 100.

6. The chimeric antigen receptor of claim 1, wherein the chimeric antigen receptor comprises the amino acid sequence of SEQ ID NO: 88.

7. An isolated nucleic acid molecule encoding the chimeric antigen receptor of any one of claims 1-6.

8. The isolated nucleic acid molecule of claim 7, wherein the nucleic acid molecule comprises a nucleotide sequence of SEQ ID NO: 87.

9. A vector comprising the nucleic acid molecule of claim 7 or 8, optionally wherein the vector is a DNA vector, an RNA vector, a plasmid, a lentivirus vector, an adenovirus vector, or a retroviral vector.

10. An isolated cell comprising a nucleic acid molecule of claim 7 or 8 or a vector of claim 9, optionally wherein the isolated cell is a human T cell.

11. An engineered cell comprising a chimeric antigen receptor of any one of claims 1-6.

12. The engineered cell of claim 11, wherein:

(a) the engineered cell is an immune cell;

(b) the engineered cell is an immune cell and the immune cell is an immune effector cell;

(c) the engineered cell is a T lymphocyte;

(d) the engineered cell is a T lymphocyte and the T lymphocyte is an inflammatory T lymphocyte, a cytotoxic T lymphocyte, a regulatory T lymphocyte, or a helper T lymphocyte; or

(e) the engineered cell is a CD8+ cytotoxic T lymphocyte.

13. A population of engineered cells, which is obtained by:

(a) introducing into a population of immune cells which have been obtained from a subject, a nucleic acid molecule encoding a chimeric antigen receptor of any one of claims 1-6;

(b) culturing the immune cells under conditions to express the nucleic acid molecules; and

(c) isolating the immune cells expressing the chimeric antigen receptor at the cells' surface.

14. A pharmaceutical composition comprising one of:

(a) a genetically-modified human T cell and a pharmaceutically acceptable carrier, wherein the genetically-modified human T cell comprises a chimeric antigen receptor according to any one of claims 1-6; or

(b) an engineered cell according to claim 11 and a pharmaceutically acceptable carrier; or

(c) an engineered cell according to claim 12 and a pharmaceutically acceptable carrier.

15. Use of the engineered cell of claim 11 or 12, or the population of engineered cells of claim 13 or the pharmaceutical composition of claim 14 in the manufacture of a medicament for treating a BCMA-expressing cancer in a subject.

16. The use of claim 15, wherein the subject is a human subject.

17. The use of claim 15 or 16, wherein the BCMA-expressing cancer is multiple myeloma, B lineage acute lymphoblastic leukemia, B-cell chronic lymphocytic leukemia, B-cell non-Hodgkin's lymphoma, leukemia and lymphoma, acute lymphoblastic leukemia, Hodgkin's lymphoma, or childhood acute lymphoblastic leukemia.

18. An *in vitro* method of engineering a population of cells to express a chimeric antigen receptor, comprising:

(a) introducing into a population of immune cells a nucleic acid molecule encoding a chimeric antigen receptor of any one of claims 1-6;

(b) culturing the immune cells under conditions to express the nucleic acid molecule; and

(c) isolating the immune cells expressing the chimeric antigen receptor at the cells' surface.

19. The *in vitro* method of claim 18, further comprising obtaining the population of immune cells from a subject.