PARTICIPANT POPULATION

The study population will consist of adult participants with r/r MM for which no standard-of-care treatment exists. For a detailed list of eligibility criteria, see Section 5.

Key Inclusion Criteria

- Previously diagnosed with MM based on standard criteria
- Part 1a and 1b (dose-escalation): Participants with r/r MM who previously received therapy with an IMiD and PI and are intolerant to or have no other option for standard-of-care treatment according to the Investigator
- Part 2 (dose expansion): Participants with r/r MM who have received at least three prior treatments and are refractory to an IMiD, a PI, and a CD38-targeted therapy
- Eastern Cooperative Oncology Group (ECOG) performance status of 0 or 1
- Life expectancy of at least 12 weeks
- Agreement to provide protocol-specific biopsy material
- Adverse events (AEs) from prior anti-cancer therapy resolved to Grade ≤1, with the following exceptions:
  - Any grade alopecia
  - Peripheral sensory or motor neuropathy must have resolved to Grade ≤2
- Measurable disease defined as defined in Section 5.1:
- Laboratory values as follows:
  - Hepatic function
  - Hematologic function
  - Creatinine ≤2.0 mg/dL and creatinine clearance ≥30 mL/min (either calculated or per 24-hour urine collection)
  - Serum calcium (corrected for albumin) level at or below the upper limit of normal (treatment of hypercalcemia is allowed and participants may enroll if hypercalcemia returns to normal with standard treatment)
- Adequate contraception

Key Exclusion Criteria

- Prior use of any monoclonal antibody, radioimmunoconjugate, or antibody-drug conjugate within 4 weeks before first RO7425781 infusion
- Prior treatment with systemic immunotherapeutic agents, including, but not limited to, cytokine therapy and anti-CTLA4, anti–PD-1, and anti–PD-L1 therapeutic antibodies, within 4 weeks before first RO7425781 infusion
- Treatment-related, immune-mediated AEs associated with prior immunotherapeutic agents as follows:
  - Grade ≥3 AEs, with the exception of Grade 3 endocrinopathy managed with replacement therapy
  - Grade ≤2 AEs that did not resolve to baseline after treatment discontinuation
- Treatment with radiotherapy, any chemotherapeutic agent, or treatment with any other anti-cancer agent (investigational or otherwise) within 4 weeks or 5 half-lives of the drug, whichever is shorter, prior to first RO7425781 infusion
- Autologous or allogeneic stem cell transplantation within 100 days prior to first RO7425781 infusion and/or signs of chronic graft versus host disease or ongoing immunosuppressive medication
- Plasma cell leukemia with circulating plasma cell ≥5%
- Prior solid organ transplantation
- History of autoimmune disease
- History of severe allergic or anaphylactic reactions to monoclonal antibody therapy (or recombinant antibody-related fusion proteins)
- Participants with known history of amyloidosis (e.g., positive Congo Red stain or equivalent in tissue biopsy)
- Participants with lesions in proximity of vital organs that may develop sudden decompensation/deterioration in the setting of a tumor flare
- Uncontrolled cancer pain
- History of other malignancy that could affect compliance with the protocol or interpretation of results
- Current or past history of central nervous system (CNS) disease, such as stroke, epilepsy, CNS vasculitis, progressive multifocal leukoencephalopathy, or CNS involvement by MM
- Significant cardiovascular disease (such as New York Heart Association Class III or IV cardiac disease, myocardial infarction within the last 6 months, unstable arrhythmias, or unstable angina) that may limit a participant's ability to adequately respond to a CRS event
- Significant active pulmonary disease
- Known active bacterial, viral, fungal, mycobacterial, parasitic, or other infection
- Received systemic immunosuppressive medications (including, but not limited to, cyclophosphamide, azathioprine, methotrexate, thalidomide, and anti-tumor necrosis factor agents) with the exception of corticosteroid treatment ≤10 mg/day prednisone or equivalent within 2 weeks prior to first dose of RO7425781

Additional Eligibility Criteria for Re-Treatment

See Section 5.3 of the protocol.