The aim of this study was to investigate the in vitro activities of polymyxin B (PB) and rifampin (RIF) in combination with ampicillin/sulbactam (AS) or cefoperazone/sulbactam (CS) against 20 multidrug-resistant Acinetobacter baumannii (MDR-AB) isolates by the checkerboard and E-test methods. Fractional inhibitory concentration index (FICI) values were defined as synergy, FICI ≤ 0.5; additivity, 0.5 < FICI ≤ 1.0; indifference, 1.0 < FICI ≤ 4.0; and antagonism, FICI > 4. Synergistic interaction was detected only for the RIF + AS and RIF + CS combinations. While the most frequently detected interaction type for PB + AS or PB + CS combinations was indifference, some showed antagonistic interactions. The detection rate of synergy was significantly higher by the checkerboard than by the E-test method, and the detection rate of indifference was significantly higher by the E-test than by the checkerboard method for RIF + AS combination (P < 0.0001). In addition, no statistically significant difference was detected between the checkerboard and E-test methods for the detection rates of interaction types for any of the other combinations (P > 0.05), except for PB + CS combination for the detection of additivity (P = 0.018). Owing to the high percentage of synergistic interactions between RIF and AS, we considered this combination as an effective therapeutic option for MDR-AB infections.