Multiple Choice Questions 31-40 for Lesson 4

1. A discrete model for population is
   (a). \( y_{k+1} - y_k = dt*(b - d)* y_k \)
   (b). \( y_{k+1} - y_k = dt*b - d*y_k \)
   (c). \( y'(t) = (b - d)y \)
   (d). \( y'(t) = c(M - y)y \)
   (e). \( y_{k+1} - y_k = dt*(b - d)* y \)

2. A continuous model for population is
   (a). \( y_{k+1} - y_k = dt*(b - d)* y_k \)
   (b). \( y_{k+1} - y_k = dt*b - d*y_k \)
   (c). \( y'(t) = b - cy \)
   (d). \( y'(t) = c(M - y)y \)
   (e). \( y_{k+1} - y_k = dt*(b - d)* y \)

3. The steady state solution(s) of \( y'(t) = c(M - y)y \) are
   (a). do not exist
   (b). \( y = 0 \)
   (c). \( y = M \)
   (d). \( y = 0 \) and \( y = M \)
   (e). \( y' = M \)

4. If \( x(t) = t^2 + 2 \) is a function, then \( x(2) \) is
   (a). \( x(2) = 6 \) the function’s value at \( t = 2 \)
   (b). the second entry of the associated array
   (c). \( (t^2 + 2)2 \)
   (d). \( 6^2 + 1 \)
   (e). (a) and (b)

5. If \( x = [3 \ 7 \ 4 -1] \) is a 4x1 array, then \( x(2) \) is
   (a). \([3 \ 7 \ 4 -1]2\)
   (b). 14
   (c). not defined because \( x \) is not a function
   (d). 4
   (e). \( x(2) = 7 \) is the second entry in the array
6. Attribute(s) of Taylor’s method
   (a). uses Taylor polynomial approximations
   (b). requires the computation of many partial derivatives
   (c). gives more accurate numerical approximations
   (d). requires the solution to have a number of derivatives
   (e). all of the above

7. Attribute(s) of Runge-Kutta method
   (a). uses Taylor polynomial approximations
   (b). avoids computations of the partial derivatives
   (c). gives more accurate numerical approximations
   (d). requires the solution to have a number of derivatives
   (e). all of the above

8. The discretization error = \( Y - y \) where
   (a). \( Y = Y^k \) is from the numerical method
   (b). \( y = y(k\times dt) \) is the exact solution
   (c). less than constant times \( (Y - y)^1 \)
   (d). less than constant times \( dt^2 \)
   (e). (a) and (b)

9. The discretization error is fourth order means
   (a). error = \( 4(Y - y) \)
   (b). error = \( (Y - y)^4 \)
   (c). error^4 is bounded by a constant
   (d). abs(error) less than constant time \( dt^4 \)
   (e). error less than constant times \( dt^4 \)

10. In the code file rk4.m the loop is done by a for loop because
    (a). no particular reason
    (b). it is a faster computation than the while loop
    (c). the number of steps will vary according to tol
    (d). for loop requires the user to give the number of steps
    (e). while loop does not require user input