Modeling Exercise 2 - Claire Wang

Problem 1:

BOD at 0 km:

$$BOD_P = BOD_L(1-E) = 240\,\frac{mg}{L} \times (1-0.45)$$
$$= 132\ mg/L$$

BOD_P, Q_P ; Q_S, BOD_S ; BOD_F

$$Q_P + Q_S = Q_F$$

$$Q_F = 7.5\times10^5\,\frac{L}{d} + 7.5\times10^6\,\frac{L}{d}$$
$$= 8.25\times10^6\,\frac{L}{d}$$

$$BOD_P Q_P + \cancelto{0}{BOD_S} Q_S = BOD_F Q_F$$

$$BOD_F = \frac{(132\ mg/L)(7.5\times10^5\ L/d)}{8.25\times10^6\,\frac{L}{d}} = 12\ mg/L$$

BOD at 10 km:

$u = 5\ km/d \rightarrow t = 2\ d$

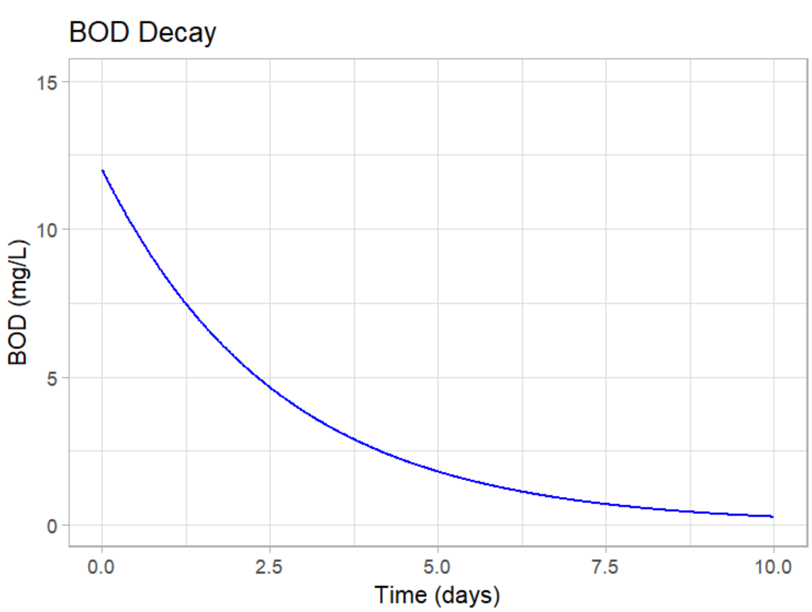
$$BOD_2 = BOD_0 e^{-kt} = (12\ mg/L)e^{(0.34+0.04)d^{-1}(2\ d)}$$
$$= 5.6\ mg/L$$

BOD at 20 km:

$t = 4\ d$

$$BOD_4 = (12\ mg/L)e^{(0.34+0.04)d^{-1}(4\ d)} = 2.6\ mg/L$$

Problem 2:



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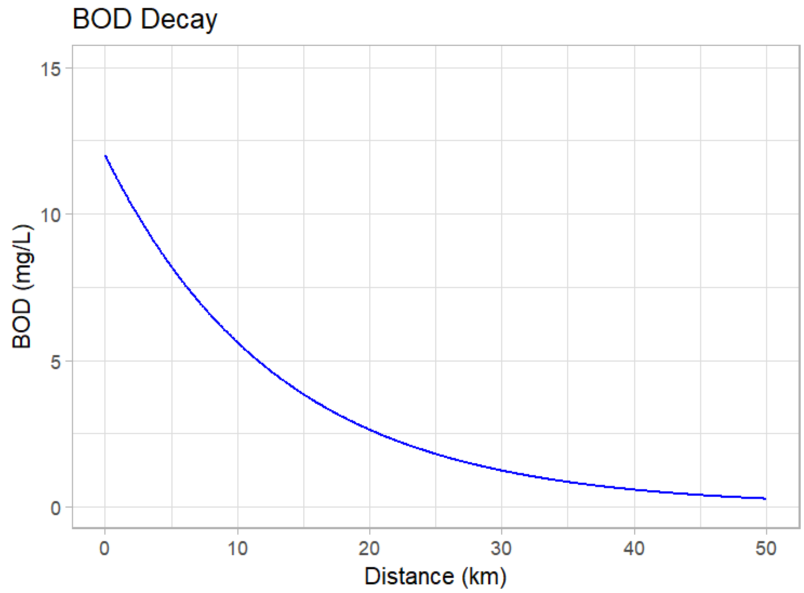
Problem 3:



	time	BOD	distance
1	0	12.0000000	0
2	1	8.2063468	5
3	2	5.6119963	10
4	3	3.8378404	15
5	4	2.6245510	20
6	5	1.7948290	25
7	6	1.2274138	30
8	7	0.8393808	35
9	8	0.5740197	40
10	9	0.3925498	45
11	10	0.2684495	50

Yes, the code predicts almost the same values as the ones calculated.