Metropolia University of Applied Sciences

0.1 ENTRANCE EXAM 06.03.2023, ; Mathematics & Physics

The duration of the exam is three (3) hours. Return your solutions in one pdf-file. In total there is seven problems in this exam (Max score 7*10=70 points).

1. Solve the following equations:
   (a) $x^2 + 3x - 4 = 0$,
   (b) $10^{x^2+1} = 10000$,
   (c) $\sin(x) = 0.5$.
2. Solve the following inequalities:
   (a) $3x + 1 > x + 2$,
   (b) $\frac{x+1}{2x-6} > 0$.
3. When horses A, B and C race together, their respective probabilities of winning are 0.3, 0.5 and 0.2. They race three times.
   (a) Find the probability that B wins all three races.
   (b) Find the probability that the same horse wins all three races.
   (c) Find the probability that A, B and C each wins one race.
4. The temperature of coffee falls according to formula $T = 15 + 55e^{-kt}$. At the time $t = 3$, the temperature $T = 40$. Find T at $t = 10$.
5. Which point on the parabola $y = 2x^2$ is closest to the point $(0, 4)$?
6. (a) A train running at the speed of 60 km/hr crosses a pole in 9 seconds. What is the length of the train?
   (b) A jetliner touches down at 310 km/h and comes to a stop 35 s later. What's the shortest runway on which this aircraft can land?
7. Resistors $R_1 = 300\Omega$ and $R_2 = 500\Omega$ are in parallel, and this pair in series with a resistor $R_3 = 400\Omega$. This combination is connected across a battery with the voltage $V = 10$ volts.
   (a) What is the resistance of the combination?
   (b) What is the current through R_3?
   (c) What is the power dissipated in R_2?