Problem 1

The formula for distance (s), speed (v) and time (t) is given by:

$$s = v * t$$

Since the distance is back and forth, this can be rewritten into:

$$2s = v * t \Leftrightarrow s = \frac{v * t}{2}$$

Plugging values into formula gives us:

0.0714

Answer: 0.0714

Problem 2

For an absolute rotary encoder with 3 photo sensors, each sensor can be either HIGH (logical 1) or LOW (logical 0).

The total number of unique binary patterns (combinations) for 3 sensors can then calculated:

$$2^3 = 8$$

This means that 8 unique patterns are possible, which means 8 different angular positions.

To determine resolution, dividing the full rotation (360°) by the number of unique positions gives us:

$$Resolution = \frac{360°}{8} = 45°$$

Answer: With 3 sensors, the encoder can resolve 45° per step. To achieve a resolution of 1°, we would need 360 unique patterns, which would require more sensors.

Problem 3

In the picture we see that there's 12 white sections, and 12 black respectively. The encoder has registered 48 pulses after 0.08 seconds. Therefore, **one revolution = 24 pulses**. Since 48 pulses are recorded in 0.08 seconds, this equals two full revolutions:

$$(\frac{48}{24} = 2)$$

To then find the revolutions per second (rev/sec), we take:

$$Revolutions\ per\ second = \frac{2}{0.08} = 25\ rev/sec$$

Answer: 25 revolutions per second.