



Questions 2, 4, 6, 7, 9 and 10 have alternatives, of which only one can be chosen.

1. Find the value of $\frac{ax}{b}$ when $a = \frac{2}{5}$ and x is one third of b .
2. a) A part of a highway 25.8 km in length from Ojoinen to Jutikkala on the northern side of Hämeenlinna was opened to traffic in the fall of 1996. The highway covered 253 hectares of land. Find the width, in metres, of the zone used for the highway.

b) Car speeds were shown on a board by the roadside. A driver noticed that his speed was 92 km/h when the speedometer in his car showed 100 km/h. Find the true speed of the car when the speedometer shows 85 km/h. The error percentage of the speedometer is the same in the whole speed range.
3. A report gave the number of CDs in a shop in 1997 as follows: 1830 on 1st January, 1271 on 15th February, 919 on 20th March, 680 on 10th May, 2838 on 10th July, 2419 on 23rd August, 1555 on 14th November, 1060 on 19th December, 449 on 31st December. The shop received 2400 new CDs on July 10. Draw a diagram representing the number of discs in the shop during 1997. (Place the months horizontally and the number of discs vertically.) Find the average amount of CDs sold in a month.
4. a) A pair of dice is thrown. Find the most probable sum of the numbers.

b) The lateral surface of a right circular cylinder can be manufactured from a sheet of rectangular plate measuring 40 cm \times 30 cm in two ways: the height of the cylinder is either 40 cm or 30 cm. Which cylinder has the greatest volume? Find the ratio of the volumes.
5. On average, the human body dissolves one gram of pure alcohol for each 10 kg of body weight in an hour. How long does it take when 8 cl of 40% alcohol (measured by volume) dissolves in the body of a person weighing 90 kg? The density of alcohol is 0.79 g/cm³.
6. a) Four tiles 15.0 cm square are set into a square so that a cross-shaped area is left between the tiles. The branches of the cross have equal widths. Find the width of a branch provided that the area of the cross is the same as the total area of the four tiles.

- b) The vertex of the graph of a second order polynomial is at $(-1, 2)$ and the graph passes through $(0, \frac{1}{2})$. Find the polynomial and its derivative. Sketch the graph of the polynomial.
7. a) An employment interview takes 25 min. on average. Suppose that the length of the interview is normally distributed $N(25, \sigma)$. Find the standard deviation σ such that the interview does not exceed 30 min with a probability of 95%.
- b) A right triangle has a leg of length 1 and the angle between the hypotenuse and this leg is α . Find the lengths of the other sides and the height drawn to the hypotenuse expressed in terms of $\sin \alpha$ and $\cos \alpha$. Find the area of the triangle.
8. The intensity of illumination from a light source is directly proportional to its effect P and inversely proportional to the square of the distance d . Find the formula for the intensity of illumination with effect P at a distance d of the light source. A light source with effect P is at a distance of 1.2 m. Another light source has the effect $3P$. Find a distance such that the latter source produces the same intensity of illumination as the former.
9. a) A business has an annual sales target of 410 000 mk. Due to delivery problems monthly sales cannot exceed 55 000 mk. The average sales for the first 7 months are s mk/month and for the last 5 months y mk/month. Express y as a function of s provided that the target is exactly achieved. Sketch the graph of $y = y(s)$. Find the domain of the function y .
- b) The wall of a hollow metal ball is 2.0 cm thick and the ball has half of the weight of a solid metal ball of equal size. Find the radius of the ball.
10. a) The foundations of a building should be of a rectangular shape. The sides of the foundations are 5.00 m and 9.00 m. The shape was checked by measuring the distances of the opposing corners and the results were 10.52 m and 10.07 m respectively. How could this happen? Find the outcome of the measurement provided that the foundations are rectangular. Find the actual distance of the 9.00 m sides from each other.
- b) Show that the sum of the angles of an arbitrary quadrilateral is 360° . Two non-adjacent vertices of a quadrilateral are connected with a line segment. Does the line segment always lie inside the quadrilateral?