1. (a) Solve the equation \( x + \frac{6}{x+1} = 4 \).
(b) Solve the equation \( x^5 + 36x = 13x^3 \).

2. (a) Find the real numbers \( a \) and \( b \) if 2 and 3 are roots of \( x^3 + ax^2 + bx + 6 = 0 \).
(b) In this problem \( A \) and \( B \) are the two points at which the graph of the equation \( x^2 + y^2 = 8 \) meets the graph of the equation \( y = |x| \). What is the length of the segment \( AB \)?

3. (a) Find an equation of the circle passing through the origin and the points with coordinates \((10, 0)\) and \((0, 8)\).
(b) Find an equation of the line tangent to the circle with equation \((x - 2)^2 + (y + 1)^2 = 25\) at the point with coordinates \((5, 3)\).

4. (a) In this problem \( c \) and \( d \) are real numbers. The point on the graph of the equation \( y = x^2 + cx + d \) which is nearest to the \( x \)-axis is \((-2, 5)\). Find the values of \( c \) and \( d \).
(b) Car \( A \) is travelling due west at a constant speed of 50 km/hr. Car \( B \) is travelling due east at a constant speed of 60 km/hr. At 1:00 p.m. car \( A \) is 40 km due north of car \( B \). At 2:00 p.m. what is the distance between the two cars (as the crow flies)?

5. A fenced property has the shape of a rhombus, as in the figure. The length of each side of the rhombus is 20 m. A dog outside the property is tethered to one corner of the rhombus as shown in the diagram. If the dog’s leash is 30 m long, how large an area can the dog cover?

6. A race track is built with two straight parallel sides and semicircles at the ends (as in the figure). The parallel sides are 100 m long and \( \frac{100}{\pi} \) m apart. Runner Alpha at position \( A \) starts running
clockwise around the track at 2 m/sec. At this precise moment a second runner Beta enters the track at position $B$ which is 100 m from position $A$, running at 5 m/sec. If Beta wants to meet Alpha as soon as possible, should he run clockwise or counterclockwise around the track to achieve his goal?

7. For what values of $x$ does $\frac{1}{x+1} + \frac{1}{2x} > 1$ hold?

8. In this problem $x, y$ and $z$ are real numbers. Find all possible values of $a$ if:

$$a = \frac{x}{|x|} + \frac{y}{|y|} + \frac{z}{|z|}.$$

9. Prove that, if $a + b + c = 0$, then $a^3 + b^3 + c^3 = 3abc$.

10. In the diagram $\triangle ABC$ is isosceles with $AB = AC$. Prove that if $LP = PM$, then $LB = CM$. 

\[ \begin{array}{c}
\text{Diagram}
\end{array} \]