Mathematics For Queensland
Year 11 Mathematics B
Chapter One

Additional Problems

Note: The algebra required to solve these questions is more difficult than that required to solve the problems in the textbook.

1. If $P(1, 6)$, $Q(-4, 3)$ and $R(-1, -2)$ are the vertices of a square, find the missing vertex.

2. If $h(x) = x + \dfrac{1}{x}$, show that $[h(x)]^2 = 2 + h(x^2)$

3. Show that the points $A(a,0), B(ab^2, 2ab)$ and $C(\dfrac{a}{b^2}, -\dfrac{2a}{b})$ are collinear for all values of a and b, where $b \neq 0$.

4. Write the equation of a line (not horizontal or vertical) that passes through the point with coordinates (m, n).

5. Find values for a and b if it is known that the lines
   $$ax + 3y - 1 = 0 \quad \text{and} \quad x + by + 1 = 0$$
   are perpendicular and that they also intersect on the y-axis.

6. A line has an x-intercept of a and a y-intercept of b such that $\dfrac{1}{a} = \dfrac{1}{b} = \dfrac{1}{2}$. Show that the line must pass through the point (2,2)

7. In Australia, we use the Celsius temperature scale, while in the USA they use the Fahrenheit temperature scale. In the Celsius temperature scale, the freezing point of water is 0^0 and the boiling point is 100^0. In the Fahrenheit scale, the freezing point of water is 32^0 and the boiling point is 212^0.

   a. Show that the formula to convert a Fahrenheit temperature to a Celsius temperature can be expressed as: $C = \dfrac{5}{9}(F - 32)$.

   b. Here is an interesting method for converting between these temperature scales. Add 40 to the number to be converted, then multiply by 9/5 or 5/9 (depending on which scale is being converted to which), and then, finally, subtract 40 from the result. The procedure works in both directions, provided that one chooses the correct multiplier.

   Show algebraically that this method does give the correct temperature, converting in both directions.