# Functions and straight-line graphs - Practice test 5

Name: _____ Date: _____

10 questions | 50 marks | 75 minutes

A more demanding synthesis paper: justify restrictions, evaluate models and combine coordinate methods.

A scientific calculator may be used.

**1.** A rule is $f(x)=\frac{x^2-9}{x-3}$, with its original algebraic domain. [5 marks]

**(a)** Simplify the rule, retaining the input restriction. [2 marks]

**(b)** Find $f(4)$ and explain why output 6 is missing. [3 marks]

**2.** A relation consists of the pairs $(-1, 2)$, $(0, 3)$ and $(1, 2)$. [4 marks]

**(a)** Is it a function of the first coordinate? Explain. [2 marks]

**(b)** If input and output roles are swapped, is the reversed relation a function? Explain. [2 marks]

**3.** A line crosses the positive axes and forms a triangle of area 12 square units with them. Its y-intercept is $(0, 6)$. [4 marks]

**(a)** Find its positive x-intercept. [2 marks]

**(b)** Find the line equation and gradient. [2 marks]

**4.** Two lines are $y = (a+1)x - 4$ and $y = 2x + 5$. [4 marks]

**(a)** Find $a$ for which they are parallel and distinct. [2 marks]

**(b)** Find $a$ for which they are perpendicular. [2 marks]

**5.** Two pumps together supply 27 litres per minute. Pump A supplies 3 litres per minute more than twice the rate of pump B. [5 marks]

**(a)** Form equations for rates $a$ and $b$ in litres per minute. [2 marks]

**(b)** Find both rates and check them. [3 marks]

**6.** A point $P(x, y)$ is equally distant from $A(-2, 0)$ and $B(4, 0)$. [5 marks]

**(a)** Write an equation using squared distances and simplify it. [3 marks]

**(b)** Explain the geometric meaning of this result. [2 marks]

**7.** A simple gas model keeps pressure $p$ times volume $V$ equal to 200, with $p$ in kPa and $V$ in litres. Both quantities are positive. [5 marks]

**(a)** Write $V$ as a function of $p$. Find $V$ at $p = 80$ and $p = 125$. [2 marks]

**(b)** Explain why the graph is not a straight line, and state its contextual domain. [3 marks]

**8.** A circle has centre $(3, -2)$ and passes through $(0, 2)$. [5 marks]

**(a)** Find its radius and write its equation. [2 marks]

**(b)** Give the lower semicircle rule and its domain and range. [3 marks]

**9.** A hire company records these charges: 8 dollars at 0 hours, 18 dollars at 2 hours and 28 dollars at 4 hours. [5 marks]

**(a)** Find a continuous linear model fitting the observations. [2 marks]

**(b)** The company might charge by each started hour instead. Explain why the three observations do not settle which tariff is used. [3 marks]

**10.** Two villages are at $P(1, 2)$ and $Q(7, 10)$, on axes measured in kilometres. A radio mast must be equally distant from both. [8 marks]

**(a)** Find the midpoint of PQ and its gradient. [2 marks]

**(b)** Find the perpendicular bisector of PQ. [3 marks]

**(c)** The mast must also lie on the y-axis. Find its position and check its distance from each village. [3 marks]