Functions and straight-line graphs - Practice test 1

10 questions | 46 marks | 70 minutes

A balanced paper on rules, graphs, linear geometry and practical models. Give exact values unless a question asks otherwise.

Equivalent correct methods earn the corresponding marks.

1. Let $f(x) = 2x - 3$. [6 marks]

(a) Find $f(-2)$. [2 marks]

$f(-2) = 2(-2) - 3 = -7$.

Answer: -7

(b) Simplify $f(a + 1)$. [2 marks]

$2(a + 1) - 3 = 2a - 1$.

Answer: $2a - 1$

(c) Find the input when the output is 11. [2 marks]

Solve $2x - 3 = 11$, giving x=7.

Answer: $x = 7$

2. Consider functions and their possible inputs. [4 marks]

(a) State the real domain and range of $g(x) = \sqrt{x + 2}$. [2 marks]

Require x+2≥0. The square root gives every non-negative output.

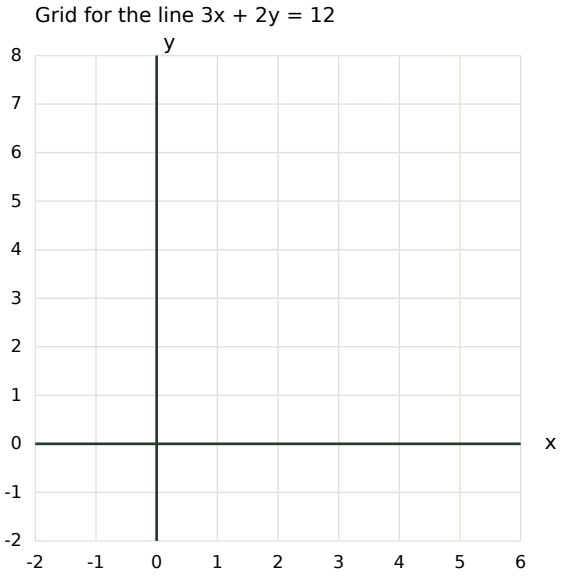
Answer: Domain $x \geq -2$; range $y \geq 0$.

(b) Does $\{(-1, 3), (0, 3), (2, 5)\}$ define a function of its first coordinate? Explain. [2 marks]

Each input has one output; repeated output 3 is allowed.

Answer: Yes.

3. A line has equation $3x + 2y = 12$. [4 marks]



(a) Find its gradient and y-intercept. [2 marks]

Rearrange to $y = -3x/2 + 6$.

Answer: Gradient $-3/2$; y-intercept (0,6).

(b) Find its x-intercept. Sketch the line on the grid, labelling both intercepts. [2 marks]

Set y=0, so 3x=12 and x=4.

Plot the two intercepts and join with a straight line.

Answer: x-intercept (4,0); draw the line through (4,0) and (0,6).

4. The line L passes through A(-1,4) and B(3,-4). [6 marks]

(a) Find an equation of L. [2 marks]

Gradient=(-4-4)/(3+1)=-2.

Using A gives 4=2+c, so c=2.

Answer: $y = -2x + 2$

(b) Find the line parallel to L through (2,5). [2 marks]

Keep gradient -2: $y - 5 = -2(x - 2)$.

Answer: $y = -2x + 9$

(c) Find the line perpendicular to L through (2,5). [2 marks]

The perpendicular gradient is 1/2.

$y - 5 = (x - 2)/2$.

Answer: $y = x/2 + 4$

5. A performance sells 9 tickets. Adult tickets cost 12 dollars and student tickets cost 7 dollars. Total revenue is 83 dollars. [5 marks]

(a) Define variables and form two equations. [2 marks]

Let a and s count adult and student tickets respectively.

Answer: $a + s = 9$ and $12a + 7s = 83$.

(b) Find the number of each type and check your answer. [3 marks]

Use s=9-a: $12a + 63 - 7a = 83$, so a=4.

Then s=5; 48+35=83 and 4+5=9.

Answer: 4 adult and 5 student tickets.

6. A segment joins A(-2,1) to B(4,9). [4 marks]

(a) Find its exact length. [2 marks]

The changes are 6 and 8, so length=$\sqrt{36+64}=10$.

Answer: 10 units.

(b) Find its midpoint. [2 marks]

Average corresponding coordinates: ((-2+4)/2,(1+9)/2).

Answer: (1,5).

7. A rectangle has fixed area 36 square metres. Its positive length is l metres and its width is w metres. [4 marks]

(a) Write w as a function of l and find w when l=9. [2 marks]

lw=36, so w=36/l; substitute l=9.

Answer: $w = 36/l$ for l>0; w=4 m.

(b) Find l when w=3. Explain what happens to w when l doubles. [2 marks]

l=36/3=12.

Replacing l by 2l gives 36/(2l), half the original width.

Answer: l=12 m; w halves.

8. A circle has centre (-1,2) and radius 3. [4 marks]

(a) Write its equation. [2 marks]

Use the centre-radius form with $r^2=9$.

Answer: $(x+1)^2+(y-2)^2=9$.

(b) State the full circle range and decide whether (2,2) is on the circle. [2 marks]

The extreme y-values are 2±3.

At (2,2), the left side is $3^2+0=9$.

Answer: Range $-1 \le y \le 5$; the point is on it.

9. A tank drains at a constant rate. The table shows its remaining volume. [4 marks]

Remaining water

Time t (min)	0	5	10
Volume V (L)	120	90	60

(a) Find a linear model V(t), with units. [2 marks]

The change is -30 L in 5 min, giving -6 L/min.

At t=0 the volume is 120 L.

Answer: $V = 120 - 6t$, V in litres and t in minutes.

(b) Find when the tank becomes empty and state a sensible domain. [2 marks]

Solve 120-6t=0.

The physical draining model stops once the volume reaches zero.

Answer: 20 min; $0 \le t \le 20$.

10. Hire company A charges $A(h) = 8 + 4h$ dollars and company B charges $B(h) = 20 + 2h$ dollars for non-negative hire time h in hours. [5 marks]

(a) Find when the charges are equal. [2 marks]

8+4h=20+2h gives h=6.

Substitute into either rule.

Answer: 6 hours; both cost 32 dollars.

(b) Explain which company is cheaper before and after that time. [3 marks]

A has the smaller starting charge but larger hourly rate.

The difference A-B=2h-12 changes sign at h=6.

Answer: A for 0≤h<6; B for h>6.