

Relations and functions Practice Test

Test A

Multiple-choice questions

- 1 If $f(x) = x^2 - x$, then $f(2-a)$ is equal to:
- A $a^2 - a + 2$
 - B $-a^2 - a + 2$
 - C $a^2 + a + 2$
 - D $a^2 - 5a + 2$
 - E $a^2 - 3a + 2$
- 2 Which one of the following is **not** a one-one function?
- A $f : R \rightarrow R$, where $f(x) = x^3 - 2$
 - B $f : R \rightarrow R$, where $f(x) = 4 - 2x$
 - C $f : R \rightarrow R$, where $f(x) = x^2 + 5$
 - D $f : [0, \infty) \rightarrow R$, where $f(x) = \sqrt{x}$
 - E $f : (-\infty, 2] \rightarrow R$, where $f(x) = 3 - (x - 2)^2$
- 3 The implied domain of the function with rule $y = \frac{1}{\sqrt{2-x}}$ is:
- A $(-2, 2)$
 - B $(-\infty, 2)$
 - C $(-2, \infty)$
 - D $(-\infty, 2]$
 - E $[2, \infty)$
- 4 The range of the function $f : (0, 5) \rightarrow R$, where $f(x) = 4 + 6x - x^2$ is:
- A $(4, 9)$
 - B $[4, 9]$
 - C $(4, 13)$
 - D $(4, 13]$
 - E $(3, 13)$

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5 A circle has centre $(3, 2)$ and radius 3. Its equation is:

A $(x+3)^2 + (y+2)^2 = 3$

B $(x+3)^2 + (y+2)^2 = 9$

C $(x-3)^2 + (y+2)^2 = 9$

D $(x-3)^2 + (y-2)^2 = 3$

E $(x-3)^2 + (y-2)^2 = 9$

[5 × 2 = 10 marks]

Short-answer questions

6 Let $f : R \rightarrow R$, where $f(x) = 4x - 8$. Find:

a $f(-2)$

b $\{x : f(x) = 12\}$

c $\{x : f(x) > 2x\}$

[1 + 1 + 2 = 4 marks]

7 a Sketch the graph of the relation $\{(x, y) : (y-4)^2 = x+2\}$.

b State the implied domain and range of this relation.

c Explain with reasons whether this relation is a function.

[2 + 2 + 1 = 5 marks]

8 The function $f : [-2, a) \rightarrow R$, where $f(x) = x^2 + 4x + 1$ has range $[-3, 13)$.

a Find the value of a .

b Determine whether f is a one-one function.

[2 + 1 = 3 marks]

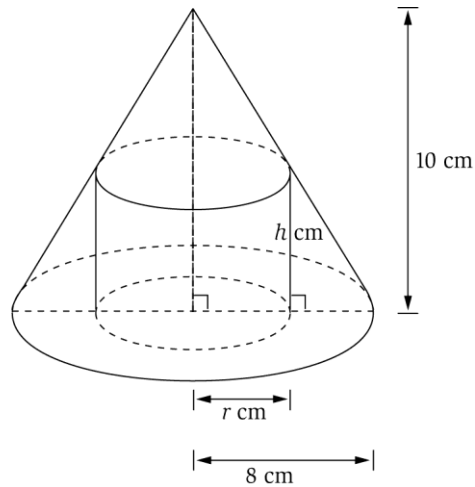
9 A circle has a diameter with endpoints $(1, 8)$ and $(-5, 0)$. Find the equation of the circle.

[3 marks]

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Extended response

- 10** A cylinder of radius r cm and height h cm is to be placed inside a cone, whose base radius is 8 cm and height is 10 cm, so that the cylinder touches the cone as shown in the diagram below.



- a** **i** Use similar triangles to show that $h = 10 - \frac{5r}{4}$.
- ii** Hence, if the volume of the cylinder is $V \text{ cm}^3$, express V in terms of r .
- b** If the radius of the cylinder is 4 cm, find
- i** the height of the cylinder.
- ii** the volume of the cylinder, correct to 2 decimal places.
- c** Find the implied domain of the function V .
- d** Suppose that the cylinder has volume $30\pi \text{ cm}^3$.
- i** Show that the radius r cm of this cylinder satisfies the equation $r^3 - 8r^2 + 24 = 0$.
- ii** Find the *exact* solutions of the equation above.
- iii** Hence find the *exact* dimensions of the cylinder with smallest radius and volume $30\pi \text{ cm}^3$ that can be placed as shown inside the cone.

[3 + 2 + 2 + 8 = 15 marks]

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