

# Domain and Range, Period and Amplitude

## 2016 Sample Exam 2 Question 2 / 2014 Exam 2 Question 2

The linear function  $f: D \rightarrow R, f(x) = 4 - x$  has range  $[-2, 6)$ . The domain  $D$  of the function is

- A.  $[-2, 6)$    B.  $(-2, 2]$    C.  $R$    D.  $(-2, 6]$    E.  $[-6, 2]$

## 2016 Sample Exam 2 Question 3 / 2013 Exam 2 Question 1

The function with rule  $f(x) = -3 \tan(2\pi x)$  has period

- A.  $\frac{2}{\pi}$    B. 2   C.  $\frac{1}{2}$    D.  $\frac{1}{4}$    E.  $2\pi$

## 2016 Sample Exam 2 Question 1 / 2014 Exam 2 Question 1

The population of wombats in a particular location varies according to the rule

$n(t) = 1200 + 400 \cos\left(\frac{\pi t}{3}\right)$ , where  $n$  is the number of wombats and  $t$  is the number of months after 1 March 2013.

- a. Find the period and amplitude of the function  $n$ . 2 marks

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## 2016 Exam 2 Question 1

The linear function  $f: D \rightarrow R, f(x) = 5 - x$  has range  $[-4, 5)$ . The domain  $D$  is

- A.  $(0, 9]$    B.  $(0, 1]$    C.  $[5, -4)$    D.  $[-9, 0)$    E.  $[1, 9)$

## 2016 Exam 2 Question 2

Let  $f: D \rightarrow R, f(x) = 1 - 2 \cos\left(\frac{\pi x}{2}\right)$ .

The period and range of this function are respectively

- A. 4 and  $[-2, 2]$    B. 4 and  $[-1, 3]$    C. 1 and  $[-1, 3]$    D.  $4\pi$  and  $[-1, 3]$    E.  $4\pi$  and  $[-2, 2]$

## 2016 Exam 2 Question 1

Let  $f: [0, 8\pi] \rightarrow R, f(x) = 2 \cos\left(\frac{x}{2}\right) + \pi$ .

- a. Find the period and range of  $f$ . 2 marks

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## 2017 NHT Exam 2 Question 2

The function with rule  $f(x) = 2 \sin\left(\frac{x}{4}\right) + 1$  has period

- A.  $\frac{\pi}{4}$    B.  $\frac{\pi}{2}$    C.  $\pi$    D.  $4\pi$    E.  $8\pi$

**2017 NHT Exam 2 Question 6**

Let  $f: D \rightarrow R, f(x) = \frac{3x-5}{2-x}$ , where  $D$  is the maximal domain of  $f$ .

Which of the following are the equations of the asymptotes of the graph of  $f$ ?

- A.  $x = 2$  and  $y = \frac{5}{3}$     B.  $x = 2$  and  $y = -3$     C.  $x = -2$  and  $y = 3$   
 D.  $x = -3$  and  $y = 2$     E.  $x = 2$  and  $y = 3$

**2017 Exam 2 Question 1**

Let  $f: R \rightarrow R, f(x) = 5 \sin(2x) - 1$ . The period and range of this function are respectively

- A.  $\pi$  and  $[-1, 4]$     B.  $2\pi$  and  $[-1, 5]$     C.  $\pi$  and  $[-6, 4]$     D.  $2\pi$  and  $[-6, 4]$     E.  $4\pi$  and  $[-6, 4]$

**2018 NHT Exam 1 Question 5**

Let  $h: R^+ \cup \{0\} \rightarrow R, h(x) = \frac{7}{x+2} - 3$ .

a. State the range of  $h$ . 1 mark

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**2018 NHT Exam 2 Question 1**

Let  $f: R \rightarrow R, f(x) = 3 - 2 \cos\left(\frac{\pi x}{4}\right)$ .

The period and range of this function are respectively

- A. 4 and  $[-2, 2]$     B. 8 and  $[1, 5]$     C.  $8\pi$  and  $[1, 5]$     D.  $8\pi$  and  $[-2, 2]$     E.  $\frac{1}{2}$  and  $[-1, 5]$

**2018 NHT Exam 2 Question 10**

The range of the function  $f: \left(\frac{-1}{\sqrt{2}}, \sqrt{2}\right] \rightarrow R, f(x) = 2x^3 - 3x + 4$  is

- A.  $(4 - \sqrt{2}, 4 + \sqrt{2})$     B.  $\left(\frac{-1}{\sqrt{2}}, \sqrt{2}\right)$     C.  $(4 - \sqrt{2}, 4 + \sqrt{2}]$     D.  $\left(\frac{-1}{\sqrt{2}}, \sqrt{2}\right]$     E.  $[4 - \sqrt{2}, 4 + \sqrt{2}]$

**2018 NHT Exam 2 Question 11**

The maximal domain of the function  $g$ , where  $g(x) = \log_e(-2x)$ , is

- A.  $R$     B.  $R^-$     C.  $R^+$     D.  $[0, \infty)$     E.  $(-\infty, 0]$

**2018 NHT Exam 2 Question 16**

Let  $f: R^+ \rightarrow R, f(x) = -\log_e(x)$  and  $g: R \rightarrow R, g(x) = x^2 + 1$ . The domain and range of  $f(g(x))$  are respectively

- A.  $R$  and  $R^+ \cup \{0\}$     B.  $R$  and  $R^-$     C.  $[1, \infty)$  and  $R^+ \cup \{0\}$     D.  $R^+$  and  $R^+ \cup \{0\}$     E.  $R$  and  $R^- \cup \{0\}$

**2018 Exam 2 Question 1**

Let  $f: R \rightarrow R, f(x) = 4 \cos\left(\frac{2\pi x}{3}\right) + 1$ .

The period of this function is

- A. 1    B. 2    C. 3    D. 4    E. 5

**2018 Exam 2 Question 2**

The maximal domain of the function  $f$  is  $R \setminus \{1\}$ . A possible rule for  $f$  is

A.  $f(x) = \frac{x^2 - 5}{x - 1}$     B.  $f(x) = \frac{x + 4}{x - 5}$     C.  $f(x) = \frac{x^2 + x + 4}{x^2 + 1}$     D.  $f(x) = \frac{5 - x^2}{1 + x}$     E.  $f(x) = \sqrt{x - 1}$

**2018 Exam 2 Question 3**

Consider the function  $f: [a, b] \rightarrow R, f(x) = \frac{1}{x}$ , where  $a$  and  $b$  are positive real numbers.

The range of  $f$  is

A.  $\left[\frac{1}{a}, \frac{1}{b}\right)$     B.  $\left(\frac{1}{a}, \frac{1}{b}\right]$     C.  $\left[\frac{1}{b}, \frac{1}{a}\right)$     D.  $\left(\frac{1}{b}, \frac{1}{a}\right]$     E.  $[a, b]$

**2019 NHT Exam 1 Question 4**

A function  $g$  has rule  $g(x) = \log_e(x - 3) + 2$ .

a. State the maximal domain of  $g$  and the range of  $g$  over its maximal domain. 2 marks

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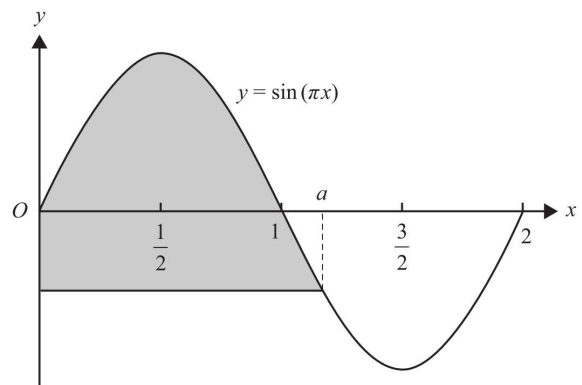
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**2019 NHT Exam 1 Question 7**

The shaded region in the diagram below is bounded by the vertical axis, the graph of the function with rule  $f(x) = \sin(\pi x)$  and the horizontal line segment that meets the graph at  $x = a$ , where  $1 \leq a \leq \frac{3}{2}$ .



Let  $A(a)$  be the area of the shaded region.

$$A(a) = \frac{1}{\pi} - \frac{1}{\pi} \cos(a\pi) - a \sin(a\pi).$$

b. Determine the range of values of  $A(a)$ . 2 marks

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**2019 NHT Exam 2 Question 1**

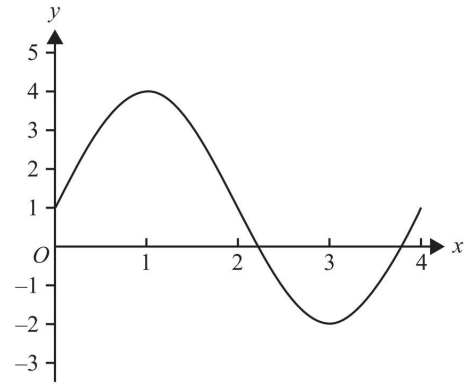
The maximal domain of the function with rule  $f(x) = x^2 + \log_e(x)$  is

A.  $R$     B.  $(0, \infty)$     C.  $[0, \infty)$     D.  $(-\infty, 0)$     E.  $[1, \infty)$

**2019 NHT Exam 2 Question 2**

The diagram below shows one cycle of a circular function. The amplitude, period and range of this function are respectively

- A. 3, 2 and  $[-2, 4]$     C. 4, 4 and  $[0, 4]$     E. 3, 4 and  $[-2, 4]$   
 B.  $3, \frac{\pi}{2}$  and  $[-2, 4]$     D.  $4, \frac{\pi}{4}$  and  $[-2, 4]$

**2019 NHT Exam 2 Question 4**

The graph of the function  $f: D \rightarrow R, f(x) = \frac{2x - 3}{4 + x}$ , where  $D$  is the maximal domain, has asymptotes

- A.  $x = -4, y = 2$     B.  $x = \frac{3}{2}, y = -4$     C.  $x = -4, y = \frac{3}{2}$     D.  $x = \frac{3}{2}, y = 2$     E.  $x = 2, y = 1$

**2019 NHT Exam 2 Question 2**

The wind speed at a weather monitoring station varies according to the function

$v(t) = 20 + 16 \sin\left(\frac{\pi t}{14}\right)$  where  $v$  is the speed of the wind, in kilometres per hour (km/h), and  $t$  is the time, in minutes, after 9 am.

a. What is the amplitude and the period of  $v(t)$ ? 2 marks

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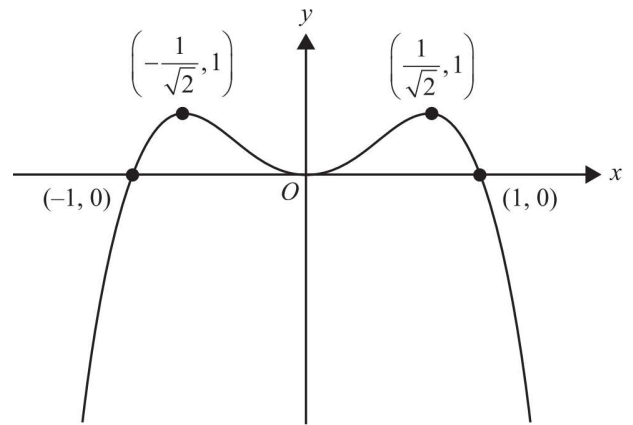


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**2019 Exam 1 Question 8**

The function  $f: R \rightarrow R, f(x) = 4x^2 - 4x^4$ .

Part of the graph of  $f$  is shown below.



The graph of  $f$  touches the  $x$ -axis at the origin.

Let  $g$  be a function with the same rule as  $f$ .

Let  $h: D \rightarrow R, h(x) = \log_e(g(x)) - \log_e(x^3 + x^2)$ ,  
where  $D$  is the maximal domain of  $h$ .

**b.** State  $D$ . 1 mark

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**c.** State the range of  $h$ . 2 marks

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**2019 Exam 2 Question 1**

Let  $f: R \rightarrow R, f(x) = 3 \sin\left(\frac{2x}{5}\right) - 2$ . The period and range of  $f$  are respectively

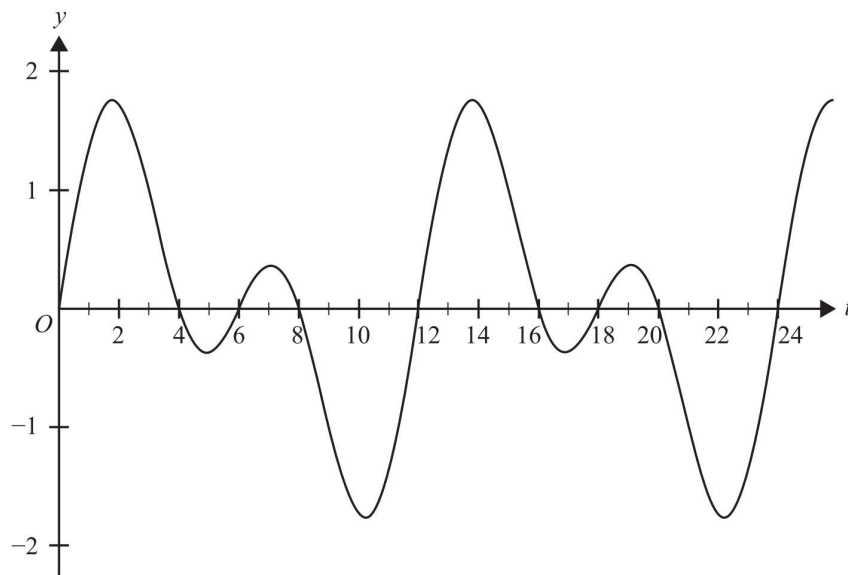
- A.**  $5\pi$  and  $[-3, 3]$    **B.**  $5\pi$  and  $[-5, 1]$    **C.**  $5\pi$  and  $[-1, 5]$    **D.**  $\frac{5\pi}{2}$  and  $[-5, 1]$    **E.**  $\frac{5\pi}{2}$  and  $[-3, 3]$

**2019 Exam 2 Question 3**

During a telephone call, a phone uses a dual-tone frequency electrical signal to communicate with the telephone exchange. The strength,  $f$ , of a simple dual-tone frequency signal is given by the function

$$f(t) = \sin\left(\frac{\pi t}{3}\right) + \sin\left(\frac{\pi t}{6}\right), \text{ where } t \text{ is a measure of time and } t \geq 0.$$

Part of the graph of  $y = f(t)$  is shown below.



a. State the period of the function. 1 mark

**2020 Exam 2 Question 5**

The graph of the function  $f: D \rightarrow R, f(x) = \frac{3x+2}{5-x}$ , where  $D$  is the maximal domain, has asymptotes

A.  $x = -5, y = \frac{3}{2}$    B.  $x = -3, y = 5$    C.  $x = \frac{2}{3}, y = -3$    D.  $x = 5, y = 3$    E.  $x = 5, y = -3$

**2020 Exam 2 Question 18**

Let  $a \in (0, \infty)$  and  $b \in R$ . Consider the function  $h: [-a, 0) \cup (0, a] \rightarrow R, h(x) = \frac{a}{x} + b$ .

The range of  $h$  is

- A.  $[b-1, b+1]$    C.  $(-\infty, b-1) \cup (b+1, \infty)$    E.  $[b-1, \infty)$   
 B.  $(b-1, b+1)$    D.  $(-\infty, b-1] \cup [b+1, \infty)$

**2020 Exam 2 Question 20**

Let  $f: R \rightarrow R, f(x) = \cos(ax)$ , where  $a \in R \setminus \{0\}$ , be a function with the property  $f(x) = f(x+h)$ , for all  $h \in Z$

Let  $g: D \rightarrow R, g(x) = \log_2(f(x))$  be a function where the range of  $g$  is  $[-1, 0]$ .

A possible interval for  $D$  is

- A.  $\left[\frac{1}{4}, \frac{5}{12}\right]$    B.  $\left[1, \frac{7}{6}\right]$    C.  $\left[\frac{5}{3}, 2\right]$    D.  $\left[-\frac{1}{3}, 0\right]$    E.  $\left[-\frac{1}{12}, \frac{1}{4}\right]$

**2021 NHT Exam 1 Question 9**

A differentiable function  $f: R \rightarrow R$  has the following properties:

- $f'(x) = f(x)(4 - f(x))$
- The range of  $f$  is  $(0, 4)$ .
- $f'(0) = 3$  if  $f(0) = 1$
- The graph of  $f$  has zero stationary points.

c. State the range of  $f'$ . 1 mark

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**2021 NHT Exam 2 Question 1**

Let  $f: R \rightarrow R, f(x) = -(\cos(2x) + \cos(4x))$  and  $g: R \rightarrow R, g(x) = 2 \cos(x)$ .

a. State the period and the amplitude of  $g$ . 1 mark

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**2021 Exam 1 Question 3**

Consider the function  $g: R \rightarrow R, g(x) = 2 \sin(2x)$ .

a. State the range of  $g$ . 1 mark

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b. State the period of  $g$ . 1 mark

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**2021 Exam 2 Question 1**

The period of the function with rule  $y = \tan\left(\frac{\pi x}{2}\right)$  is

- A. 1    B. 2    C. 4    D.  $2\pi$     E.  $4\pi$

**2021 Exam 2 Question 3**

Let  $q(x) = \log_e(x^2 - 1) - \log_e(1 - x)$ .

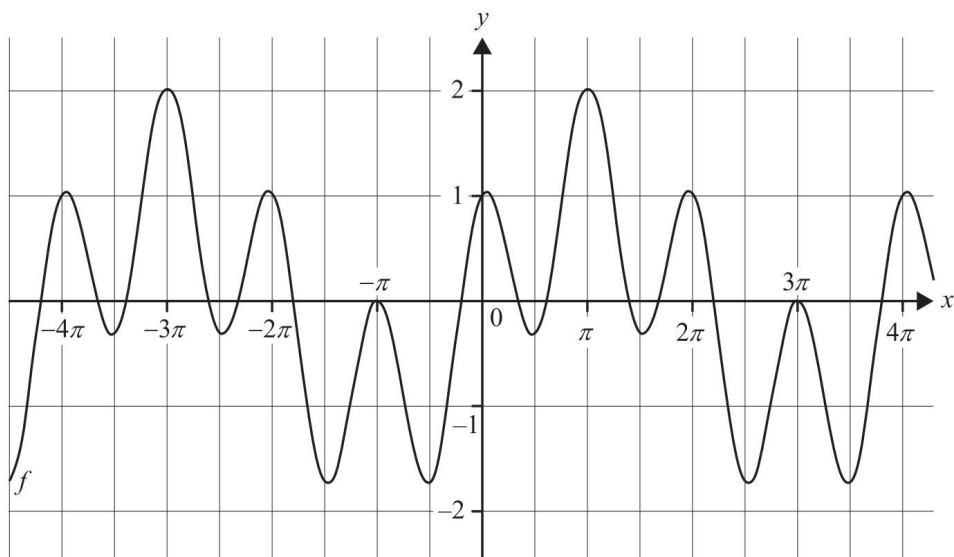
a. State the maximal domain and the range of  $q$ . 2 marks

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### 2021 Exam 2 Question 5

Part of the graph of  $f: R \rightarrow R, f(x) = \sin\left(\frac{x}{2}\right) \cos(2x)$  is shown below.



a. State the period of  $f$ . 1 mark

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