



TMUA TOPIC TEST

Transformations Part b Topic Test

Time limit: 40 minutes

Calculators: not permitted

Format: 10 multiple-choice questions

This is a TMUA-style topic test: a timed set of TMUA-style questions, with a particular focus on a given topic. You can also sit this test online at jzmaths.com, where the result will count towards your mastery score.

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Question 1

Let $f(t) = \sin t$ and define $g(x) = 2f(2\pi - |3x|) + 1$. How many solutions does $g(x) = 0$ have in the interval $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$?

A 6

B 3

C 4

D 8

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Question 2

A point (p, q) on the graph of $y = f(x)$, where $q \neq 0$, produces exactly two corresponding points on the graph of $y = 5 - 2f(3 - |2x + 1|)$. The x -coordinates of these two points differ by 4, and their common y -coordinate is 9. What is the value of p/q ?

A -2

B $\frac{1}{2}$

C 2

D $-\frac{1}{2}$

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Question 3

Let $k > 1$. Which of the following conditions both **guarantees** that the graph

$$y = |3 - 2|\ln(k - |2x - 1|)|$$

has exactly four distinct intersections with the x -axis and **is required** for this to occur?

- A $k = e^{3/2}$
- B $k \geq e^{3/2}$
- C $k > e^2$
- D $k > e^{3/2}$
- E $1 < k \leq e^{3/2}$

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Question 4

Given $f(x) = x^4 - 2x^2$, let the curve C be given by the 90° clockwise rotation about $(2, 5)$ of $y = |f(x)| + 1$. How many intercepts does C have with the line $x = -1$?

A 1

B 2

C 3

D 4

E 5

F 6

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Question 5

The equation $f(u) = -2$ has exactly three real solutions, namely $u = -1$, $u = 2$ and $u = 5$, while the equation $f(u) = \frac{2}{3}$ has no real solutions. Define $g(x) = 4 - |3f(5 - |2x - 1|) + 2|$. How many real solutions does $g(x) = 0$ have?

A 3

B 4

C 5

D 6

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Question 6

Let $f(t) = t^3 - 3t$ and define $g(x) = |f(2x - 1) - 1| - 1$. How many distinct x -intercepts does the graph of $y = g(x)$ have?

A 3

B 4

C 6

D 5

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Question 7

Let $f_k(x) = x^4 - 4x^2 + k$. Starting with $y = f_k(x)$, Sequence P translates the graph horizontally by +3 units, translates it vertically by +1 unit, applies a vertical modulus transformation, and then reflects it in $y = 2$. Sequence Q applies the vertical modulus transformation first, then translates horizontally by +3 units, translates vertically by +1 unit, and reflects in $y = 2$. For which values of k do the two sequences produce the same final graph?

A $k \geq 4$

B $k > 4$

C $k \leq 4$

D $k \in \mathbb{R}$

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Question 8

Let f be any real-valued function on $\mathbb{R}$, and define

$$g(x) = f(2 - |x|)(2 - f(2 - |x|)), \quad h(x) = f(2 - x)(2 - f(2 - x)).$$

Which condition is **sufficient but not necessary** for $g(x) = h(x)$ for every real x ?

- A For every real t , $f(t) \geq -1$.
- B For every real t , $f(2 + t) = f(2 - t)$.
- C For every real t , $f(-t) = -f(t)$.
- D The function f is one-to-one.
- E For every real t , $f(2 + t) = -f(2 - t)$.

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Question 9

Let $f(x) = x^3 - 3x$. In both sequences, first stretch $y = f(x)$ horizontally by scale factor $1/2$ and then translate it horizontally by $+1$. Sequence P next translates vertically by $+2$ and then applies a vertical modulus transformation. Sequence Q applies the vertical modulus transformation before translating vertically by $+2$. Which statement is correct?

- A Sequence P produces exactly one more local maximum than Sequence Q.
- B Sequence Q produces exactly one more local maximum than Sequence P.
- C Both sequences produce exactly one local maximum.
- D Both sequences produce exactly two local maxima.

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Question 10

Let f be a function for which

$$\int_0^4 |f(u) - 1| du = 3.$$

Define $g(x) = 5 - 2|f(4 - |2x - 1|) - 1|$. What is the value of $\int_{-3/2}^{5/2} g(x) dx$?

- A 8
- B 14
- C 17
- D 20

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