Brainiacs Math Olympiad Preliminary Round Sample Exam Paper 2

Category V – grades 11 and 12

Q1.

Solve for all values of x that satisfy the equation:

$$(x+2)(x+4)(x-6)(x-8) = 2925$$

A. $\{-7, \ -11\}$
B. $\{7, 11\}$
C. $\{7, \ -11\}$
D. $\{-7, 11\}$

Q2.

A is a number which is divisible by both 2 and 9 and A has exactly 15 positive divisors.
Find the remainder when A is divided by 5?
A. 1
B. 2
C. 3
D. 4

Q3.

How many different necklaces can we make by threading 3 different red beads, 3 different green beads and 3 different yellow beads onto a chain if beads of the same color must be kept together?

A. 240
B. 216
C. 196
D. 174

Q4.

What is the remainder when $777^{777} + 222^{222}$ is divided by 8 ?

A. 2
B. 7
C. 1
D. 4

Q5.

What is the coefficient of the term containing $x^{12}y^6$ in the expansion of $(x^3 - 2y^2)^7$?

A. 84
B. -280
C. -324
D. 560

Q6.

What is the remainder when $n(n^2-1)(5n+2)$ divide by 24 for all natural values of n.

A. 0
B. 1
C. 8
D. 12

Q7.

What is the answer of $\sqrt{3+8\sqrt{7+4\sqrt{3}}} - \sqrt{3} = ?$
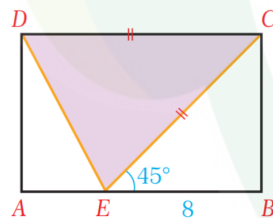
A. 1
B. 2
C. 3
D. 4

Q8.

If $g(x) + 2 \cdot g\left(\dfrac{1}{x}\right) = x$, find $g(x)$ in terms of x.

A. $\dfrac{2-x^2}{3x}$

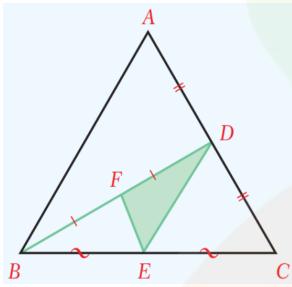B. $\dfrac{2}{3x}$

C. $\dfrac{2x}{3}$

D. $\dfrac{2-x}{3}$

Q9.

In the figure, $ABCD$ is a rectangle, $EB = 8$, $m(\angle BEC) = 45°$ and $EC = DC$. Find the area of $\triangle CDE$.

A. $16\sqrt{2}$

B. $32\sqrt{2}$

C. $36\sqrt{3}$

D. $18\sqrt{3}$

Q10.

The figure shows a triangle ABC. BD is the median of side AC in ΔABC, DE is the median of side BC in ΔBCD, and EF is the median of side BD in ΔBDE. Given that A(ΔDEF) = $5\ cm^2$, find A(ΔABC).

A. $25\ cm^2$
B. $30\ cm^2$
C. $35\ cm^2$
D. $40\ cm^2$

Q11.

Two points D and E lie respectively on sides AB and AC of a triangle ABC.
Given that DE & BC, AE = 2 cm, EC = 3 cm and A(BCED) = $42\ cm^2$, find A(ΔABC).
A. $90\ cm^2$
B. $82\ cm^2$
C. $65\ cm^2$
D. $50\ cm^2$

Q12.

ABCD is a trapezoid with bases AB and DC. AB = 26, BC = 16, CD = 6 and AD = 12 are given. Find the area of the trapezoid.

A. 142.4
B. 153.6
C. 162.4
D. 164.6

Q13.

Find $\lim\limits_{x \to \frac{7\pi}{2}} \dfrac{\sin x + \cos x}{\cos 2x}$.

A. $\dfrac{\sqrt{2}}{2}$

B. $-\dfrac{\sqrt{2}}{2}$

C. $\sqrt{2}$

D. 0

Q14.

Find $\lim\limits_{x \to 3} \dfrac{x^2 - 9}{2 - \sqrt{x + 1}}$.

A. -24
B. 24
C. -10
D. 10

Q15.

An arrow is shot upward on a planet. Its height (in meters) after t seconds is given by
$h(t) = 60t - 0.6t^2$.
What will be the velocity of the arrow when it strikes the ground?
A. 45
B. 50
C. 60
D. 75

Q16.

Given that $f\left(4 \bullet g(x) + 7\right) = x^3 - 2x^2 + 3$ and $g(x) = 1 - x$, find $f^I(-1)$.

A. -1
B. $-\dfrac{15}{4}$
C. $-\dfrac{13}{4}$
D. $-\dfrac{17}{4}$

Q17.

Find $a + b + c$, so that $f(x) = ax^3 - 3x^2 + bx + c$ has an inflection point at the point $(-1, 1)$ and a local extremum at $x = -2$.

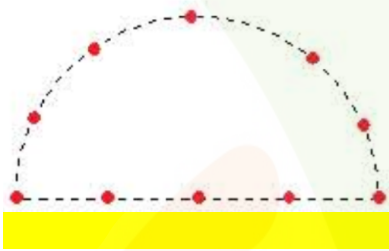A. -1
B. 0
C. 2
D. 3

Q18.

Jack has 5 different history books and 4 different math books. In how many ways can he arrange them all on a shelf so that the history books are together and all the books are between two math books?

A. 2640
B. 2880
C. 5160
D. 8640

Q19.

The figure shows ten points. Three of the points are chosen at random to form a triangle. How many different triangles can be constructed?

A. 90
B. 100
C. 110
D. 120

Q20.

A number is selected at random from the set $A = \{1, 2, 3, \ldots, 180\}$. What is the probability that the selected number is neither divisible by 3 nor divisible by 5?

A. $\dfrac{4}{15}$

B. $\dfrac{8}{15}$

C. $\dfrac{11}{15}$

D. $\dfrac{13}{15}$