NAM DINH DEPARTMENT OF EDUCATION AND TRAINING

OFFICIAL

CONTEST OF MATH AND SCIENCE IN ENGLISH
School year: 2020-2021
Subject: MATH – Grade 8
Time allowed: 90 minutes

CODE: 101

I. PART 1. MULTIPLE CHOICES QUESTIONS (7.0 points)

Write the correct answer (A, B, C or D) for each of the following questions in the correspondingly numbered space on your answer sheet.

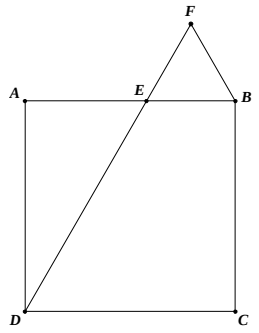
Question 1. Quadrilateral *ABCD* is a rhombus with perimeter $48cm$. The length of the side of rhombus is equal to

A. $16cm$ **B.** $9cm$ **C.** $24cm$ **D.** $12cm$

Question 2. Let *ABCD* be a parallelogram such that $\widehat{ADB} = 90^o$, $AB = 5, AD = 3$, then *AC* is

A. 4 **B.** 8 **C.** $2\sqrt{13}$ **D.** $\sqrt{13}$

Question 3. On the right figure, let *ABCD* be a square, *E* and *F* are two points on *AB* and *DE*, respectively such that *BEF* is an equilateral triangle. If $AB = \sqrt{3}$, then *EF* is equal to



A. $\frac{\sqrt{3}}{2}$ **B.** $2-\sqrt{3}$

C. $\sqrt{3}-1$ **D.** $\frac{\sqrt{3}}{3}$

Question 4. The sum of all angles in a quadrilateral is equal to

A. 270^o **B.** 540^o **C.** 360^o **D.** 180^o

Question 5. Let $Q(x) = 2x^3 + ax^2 + bx + c$ where a, b, c are given constants. If $Q(0) = 1, Q(-1) = 2, Q(2) = 3$, the value of $a + b + c$ is equal to

A. $-\frac{14}{3}$ **B.** $\frac{20}{3}$ **C.** 4 **D.** -2

Question 6. Let a be a positive number such that $\left|a - \frac{1}{a}\right| = 1$. The value of $a^2 + \frac{1}{a^2}$ is equal to

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

Question 7. The value of $A = \frac{x^3 + 27}{x + 3} - \frac{x^4 - 16}{x^2 + 4}$ with $x = \frac{1}{4}$ is equal to

A. $\frac{21}{5}$ **B.** $\frac{49}{4}$ **C.** $\frac{43}{4}$ **D.** $\frac{61}{4}$

Question 8. Given expression $\frac{x+1}{x^2(x+2)} + \frac{3}{|x+2|}$. The expression is well-defined with which of the following conditions of x?

A. $x \neq -2$ **B.** $x \neq 0$ or $x \neq -2$ **C.** $x \neq 0$ **D.** $x \neq 0$ *and* $x \neq -2$

Question 9. Given trapezoid *ABCD* with *AB* and *CD* parallel and $\hat{A} - \hat{D} = 40^o, \hat{B} = 5\hat{C}$. Then $\hat{A} + \hat{B}$ is equal to

A. 100^o **B.** 140^o **C.** 220^o **D.** 260^o

Question 10. Calulate the sum of all coefficients in the expansion of expression $\left(x^2-2x-3\right)^7$.

A. -4 **B.** -2187 **C.** -16384 **D.** -78125

Question 11. Let n be an integer. Suppose that n^2+n-2 is divisible by $n+1$. What is the value of n?

A. 1 **B.** 4 **C.** 2 **D.** 3

Question 12. What is the solution of $A=2x^5-\frac{1}{2}x^3+\frac{3}{4}x^2-1$ with $x=-2$?

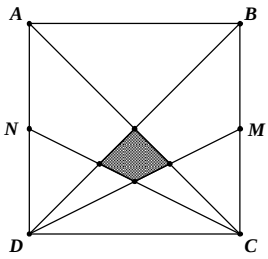
A. -58 **B.** 64 **C.** -64 **D.** 58

Question 13. Factorize the polynomial $x^4+2020x^2+2019x+2020.$

A. $(x+1)\left(x^2+x+2020\right)$ **B.** $\left(x^2+x+1\right)\left(x^2-x+2020\right)$

C. $(x+2020)\left(x^3+2020x+2019\right)$ **D.** $(x+1)^2\left(x^2-x+2020\right)$

Question 14. On the right figure, given square *ABCD* with $AB=10$. Assume that *M* and *N* are mid-points of the sides *AD* and *BC*, respectively. The area of the black space is equal to



A. $\frac{25}{7}$ **B.** 5

C. $\frac{25}{6}$ **D.** $\frac{25}{12}$

Question 15. Let $ABCD$ be an isosceles trapezoid with two bases *AB*, *CD* and *AC* is perpendicular to *BD*. The line *AC* meets *BD* at *K*. If $AC=12$ and $AK=4$ then *DC* is equal to

A. $4\sqrt{2}$ **B.** $8\sqrt{2}$ **C.** 4 **D.** 8

Question 16. Which of the following statements is **false**?

A. $(2-a)\left[(a+1)^2+3\right]=8-a^3$ **B.** $(b-a)\left(a^2+b^2+ab\right)=b^3-a^3$

C. $\left(a^2-b^2\right)\left(a^2+b^2\right)=a^4-b^4$ **D.** $\left(a^2-b^2\right)(a+b)=a^3-b^3$

Question 17. Given trapezoid $ABCD$ with two bases *AB, CD*. Suppose that *M* and *N* are mid-points of the sides *AD* and *BC*. Let *AC* and *BD* intersect *MN* at *I* and *K*, respectively. If $AB=6\text{cm}, CD=8\text{cm}$ then *IK* is equal to

A. $3cm$ **B.** $4cm$ **C.** $7cm$ **D.** $1cm$

Question 18. The quotient of the division of polynomial $2019x^{2018}y^{2020}-3x^4y^6$ by polynomial $\frac{3}{2}x^3y^2$ is equal to

A. $\frac{6057}{2}x^{2015}y^{2018}-\frac{9}{2}xy^4$ **B.** $1346x^{2021}y^{2022}-2x^7y^8$

C. $1346x^{2015}y^{2018}-2xy^4$ **D.** $\frac{6057}{2}x^{2021}y^{2022}-\frac{9}{2}x^7y^8$

Question 19. Given square *ABCD, E* is mid-point of *AB* and *F* ispoint on *BC* such that $BF=2FC$. If $AB=6$, then *EF* is

A. 5 **B.** 6 **C.** 7 **D.** 4

Question 20. The common denominator of $\frac{1}{(x-1)\left(4x^2-4x+1\right)}$ and $\frac{x+1}{(2x-1)\left(x^2-2x+1\right)}$ is equal to

A. $(x-1)^2(1-2x)^2$ **B.** $(x-1)^2(2x-1)$ **C.** $(2x-1)\left(4x^2-4x+1\right)$ **D.** $(2x-1)(x-1)$

Question 21. Find the minimum value of the expression $2x^2-4|x-2|-8x+3$.

A. -7 **B.** -6 **C.** 3 **D.** -5

Question 22. Given rectangular *ABCD* with $AB=4, AD=6$, *M* and *N* are two points on the sides *AB* and *DC*, respectively such that $AM=MB$ and $DN=2NC$. The area of triangle *DMN* is equal to

A. 8 **B.** 6 **C.** 4 **D.** 12

Question 23. The coefficient of x^2 in the expansion of $(1+x)(2+x^2)(3+x^3)...(7+x^7)$ is equal to

A. 1 **B.** 5040 **C.** 2520 **D.** 28

Question 24. Simplify the expression $\left(\frac{1-x^3}{1-x}-x\right):\left(\frac{1-x}{1+x^2}\right)$?

A. $\frac{(1+x^2)^2}{1-x}$ **B.** $1-x$ **C.** $\frac{1+x^2}{1-x}$ **D.** $\frac{x^2+x+1}{1+x^2}$

Question 25. Simlify the expression $\frac{1}{x^2-3x+2}-\frac{3}{4-2x}$?

A. $\frac{3x-1}{x^2-3x+2}$ **B.** $\frac{1-3x}{2(x-1)(x-2)}$ **C.** $\frac{5-3x}{2(x^2-3x+2)}$ **D.** $\frac{3x-1}{2(x-1)(x-2)}$

Question 26. Suppose that *x* and *y* are two integer numbers such that $x-y-xy=79$ and $x^2+y^2=130$. The value of $(x-y+1)^2$ is equal to

A. 209 **B.** 288 **C.** 260 **D.** 289

Question 27. The value of expression $A=x^5-3x^2y^3+3x^3y^2-y^5$ with $x=-2$ and $y=3$ is equal to

A. -103 **B.** -167 **C.** -815 **D.** -383

Question 28. Given triangle *ABC* with the right angle *A*. Let *M* be a point on *BC* such that $BM=2MC$. If $AB=3cm,\ AC=4cm$ then the area of triangle *ACM* is equal to

A. $2cm^2$ **B.** $6cm^2$ **C.** $4cm^2$ **D.** $3cm^2$

Question 29. A square is inscribed inside a rhombus with diagonals 6 and 10. Find the area of the square.

A. $\frac{225}{64}$ **B.** $\frac{15}{4}$ **C.** $\frac{225}{16}$ **D.** $\frac{15}{8}$

Question 30. Given the lengths of sides of a rectangular are $6cm$ and $8cm$, respectively. What is the length of the diagonal?

A. $8cm$ **B.** $6cm$ **C.** $10cm$ **D.** $12cm$

Question 31. What is the value of *x* in $\frac{-3x^2+2x+1}{x^2+3x-4}=1$?

A. $x=-\frac{1}{3}$ **B.** Does not exists *x*

C. $x=-\frac{5}{4}$ **D.** $x=1$ or $x=-\frac{1}{3}$

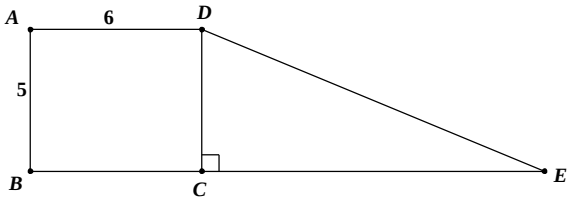
Question 32. Given trapezoid *ABCD* with two bases $AB=3cm, CD=13cm$. Suppose that the area of the trapezoid is $48cm^2$. The height *AH* is equal to

A. $6cm$ **B.** $3cm$ **C.** $24cm$ **D.** $1,5cm$

Question 33. Let a,b be a real numbers such that $\frac{2x+1}{x^2+6x+9}=\frac{a}{x+3}+\frac{b}{(x+3)^2}$. The value of $a+b$ is equal to

A. 1 **B.** -3 **C.** -5 **D.** 7

Question 34. On the right figure, given rectangle *ABCD* and right triangle *DCE* which have the same area. The height *DE* is equal to



A. 13 **B.** $5\sqrt{2}$

C. 12 **D.** $\sqrt{125}$

Question 35. Suppose that polynomial $x^4+2x^3+x^2+m$ is divisible by polynomial x^2+x-1. The value of *m* is

A. 1 **B.** 4 **C.** -2 **D.** -1

II. PART II. PROBLEM SOLVING (3.0 points)

Write the solutions to the following problems in the provided space on your answer sheet.

Problem 1. Find all prime numbers *p* such that $16p+1$ is a perfect cube.

Problem 2. A pair of numbers are *twin primes* if they differ by two and both are primes. Prove that, except the pair $\{3;5\}$, the sum of any pair of twin primes is a multiple of 12.

Problem 3. In rectangle *ABCD*, the length of side *AB* is twice as the length of side *BC*. A point *P* is taken on side *AB* such that $BP=\frac{1}{4}AB$. Show that *BD* is perpendicular to *CP*.

-THE END-

Student's full name: …….. Student's ID: ……...

First observer's name and signature: …….. Second observer's name and signature: ……..