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: 103

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

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

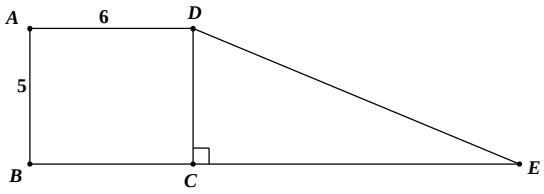
Question 2. A square is inscribed inside a rhombus with diagonals 6 and 10. Find the area of the square.

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

Question 3. Let n be an integer. Suppose that n^2+n-2 is divisible by $n+1$. What is the value of n?

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

Question 4. On the right figure, given rectangle *ABCD* and right triangle *DCE* which have the same area. The height *DE* is equal to



A. $5\sqrt{2}$ **B.** $\sqrt{125}$

C. 13 **D.** 12

Question 5. 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.** $x\neq 0$ **C.** $x\neq 0$ *and* $x\neq -2$ **D.** $x\neq 0$ or $x\neq -2$

Question 6. 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.** 7 **C.** 6 **D.** 4

Question 7. 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.** -58 **C.** -64 **D.** 64

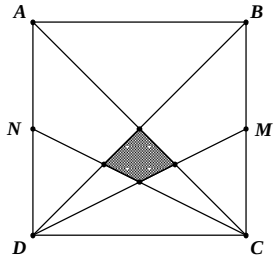
Question 8. Quadrilateral *ABCD* is a rhombus with perimeter $48cm$. The length of the side of rhombus is equal to

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

Question 9. 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.** 289 **C.** 260 **D.** 288

Question 10. 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. $\frac{25}{12}$ **D.** $\frac{25}{6}$

Question 11. Factorize the polynomial $x^4+2020x^2+2019x+2020$.

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

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

Question 12. Let $ABCD$ be a parallelogram such that $\widehat{ADB}=90^o$, $AB=5, AD=3$, then AC is

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

Question 13. 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. 4 **B.** -2 **C.** $-\frac{14}{3}$ **D.** $\frac{20}{3}$

Question 14. The sum of all angles in a quadrilateral is equal to

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

Question 15. Find the minimum value of the expression $2x^2-4|x-2|-8x+3$.

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

Question 16. The common denominator of $\frac{1}{(x-1)(4x^2-4x+1)}$ and $\frac{x+1}{(2x-1)(x^2-2x+1)}$ is equal to

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

Question 17. 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.** 220^o **C.** 140^o **D.** 260^o

Question 18. 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. $4cm^2$ **B.** $3cm^2$ **C.** $6cm^2$ **D.** $2cm^2$

Question 19. 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. $1cm$ **B.** $7cm$ **C.** $4cm$ **D.** $3cm$

Question 20. 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. $\frac{43}{4}$ **B.** $\frac{21}{5}$ **C.** $\frac{61}{4}$ **D.** $\frac{49}{4}$

Question 21. Given the lengths of sides of a rectangular are $6cm$ and $8cm$, respectively. What is the length of the diagonal?

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

Question 22. Simplify the expression $\left(\frac{1-x^3}{1-x}-x\right):\left(\frac{1-x}{1+x^2}\right)$?

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

Question 23. 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. $1346x^{2021}y^{2022}-2x^7y^8$ **B.** $\frac{6057}{2}x^{2021}y^{2022}-\frac{9}{2}x^7y^8$

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

Question 24. Which of the following statements is **false**?

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

C. $\left(2-a\right)\left[\left(a+1\right)^2+3\right]=8-a^3$ **D.** $\left(a^2-b^2\right)\left(a^2+b^2\right)=a^4-b^4$

Question 25. Let a,b be a real numbers such that $\frac{2x+1}{x^2+6x+9}=\frac{a}{x+3}+\frac{b}{\left(x+3\right)^2}$. The value of $a+b$ is equal to

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

Question 26. 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. $3cm$ **B.** $6cm$ **C.** $1,5cm$ **D.** $24cm$

Question 27. 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. 12 **B.** 8 **C.** 6 **D.** 4

Question 28. Calulate the sum of all coefficients in the expansion of expression $\left(x^2-2x-3\right)^7$.

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

Question 29. Simlify the expression $\frac{1}{x^2-3x+2}-\frac{3}{4-2x}$?

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

Question 30. What is the value of x in $\frac{-3x^2+2x+1}{x^2+3x-4}=1$?

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

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

Question 31. The coefficient of x^2 in the expansion of $\left(1+x\right)\left(2+x^2\right)\left(3+x^3\right)...\left(7+x^7\right)$ is equal to

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

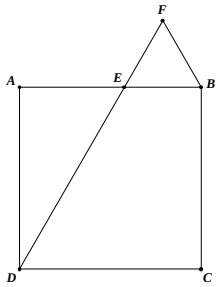
Question 32. Let $ABCD$ be an isosceles trapezoid with two bases *AB, CD* and *AC* is perpendicular to *BD*. The line *AC* meets *BD* at *K*. If $AC=12$ and $AK=4$ then *DC* is equal to

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

Question 33. 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. -167 **B.** -383 **C.** -103 **D.** -815

Question 34. 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. $\sqrt{3}-1$ **B.** $\frac{\sqrt{3}}{2}$

C. $\frac{\sqrt{3}}{3}$ **D.** $2-\sqrt{3}$

Question 35. 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. 1 **B.** 2 **C.** 3 **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: ……..