Final Examination 2018 – 2019
Mathematics Compulsory Part
Paper 2

Form Six

Name: _____
Class: _____( )

- **Time allowed : 1 hour and 15 minutes**
- **Answer ALL questions. All the answers must be marked on the MC answer sheet with pencil or marks will be deducted.**
- **The diagrams are not necessarily drawn to scale.**

Section A

1. $\frac{9^{3n-1}}{3^{9n-1}} =$

   A. $\frac{1}{3}$.
   B. $\frac{1}{3^{3n-1}}$.
   C. $\frac{1}{27^{n}}$.
   D. $\frac{1}{3^{3n+1}}$.

2. If $\frac{x+b}{a-x} = c$, then $x =$

   A. $\frac{ac+b}{1+c}$.
   B. $\frac{ac-b}{1+c}$.
   C. $\frac{ac+b}{1-c}$.
   D. $\frac{ac-b}{1-c}$.

3. $4a^2 - 20a - 9b^2 + 25 =$

   A. $(2a-3b-5)(2a+3b-5)$.
   B. $(2a-3b+5)(2a+3b+5)$.
   C. $(2a-3b-5)(2a-3b+5)$.
   D. $(2a+3b-5)(2a+3b+5)$.

4. $\frac{\cos(\pi^\circ)}{18} =$

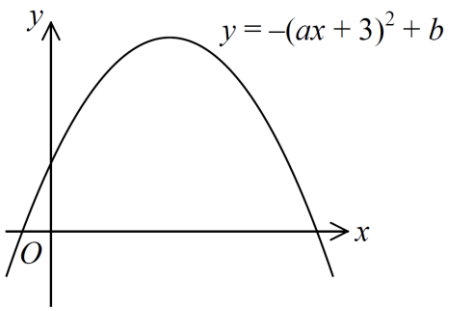
   A. 0 (correct to 1 significant figure).
   B. 0.0 (correct to 1 decimal place).
   C. 0.055 (correct to 2 decimal places).
   D. 0.0555 (correct to 3 significant figures).

5. $\frac{1}{(5x+9y)^2} - \frac{1}{(5x-9y)^2} =$

   A. $\frac{-180xy}{(5x-9y)^2(5x+9y)^2}$.
   B. $\frac{-90xy}{(5x-9y)^2(5x+9y)^2}$.
   C. $\frac{90xy}{(5x-9y)^2(5x+9y)^2}$.
   D. $\frac{180xy}{(5x-9y)^2(5x+9y)^2}$.

6. Solve $9 - 4x < 3 - 2x$ or $10 - 2x > x - 11$.

   A. x is any real value
   B. No solution
   C. $3 < x < 7$
   D. $x < 3$ or $x > 7$

7. 

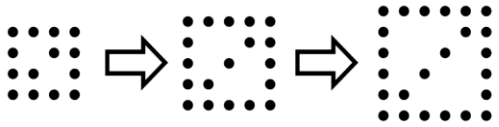
The figure shows the graph of $y = -(ax + 3)^2 + b$, where a and b are constants. Which of the following is/are true?

I. $a > 0$
II. $b > 0$
III. $b > 9$

A. I only
B. II only
C. I and II only
D. II and III only

8. If $f(x) = 4x^2 - 3x - 1$, then $\dfrac{1}{f\left(\dfrac{1}{x}\right)} =$

A. $(4x + 1)(x - 1)$.
B. $\dfrac{x^2}{(x - 4)(x + 1)}$.
C. $\dfrac{x^2}{(x + 4)(x - 1)}$.
D. $\dfrac{x^2}{(x + 4)(1 - x)}$.

9. 

In the figure, the 1st pattern consists of 14 dots. For any positive integer n, the $(n + 1)^{\text{th}}$ pattern is formed by adding 5 dots to the n^{th} pattern. Find the number of dots in the 8th pattern.

A. 49
B. 54
C. 59
D. 64

10. A sum of \$5000 is deposited at an interest rate of 4% per annum for 5 years, compounded quarterly. Find the interest correct to the nearest dollar.

A. \$1000
B. \$1080
C. \$1083
D. \$1101

11. If a and b are non-zero numbers such that $(4a - 5b) : (2a + 3b) = 17 : 10$, then $a : b =$

A. 115 : 48 .
B. 101 : 6 .
C. 6 : 101 .
D. 48 : 115 .

12. It is given that z varies directly as $\sqrt[3]{x}$ and inversely as $\sqrt{y}$. If x is decreased by 27.1% and y is increased by 44%, then z is

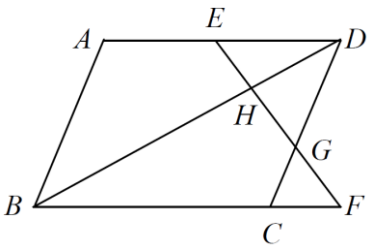
A. increased by 33.3% .
B. decreased by 25% .
C. decreased by 49% .
D. decreased by 75% .

13. Let $f(x) = 2x^{10} + ax^5 + b$, where a and b are constants. When $f(x)$ is divided by $x - 2$, the remainder is 2052. Find the remainder when $f(x)$ is divided by $x + 1$.

A. $2 - 11a$
B. $2 + 11a$
C. $6 - 33a$
D. $6 + 33a$

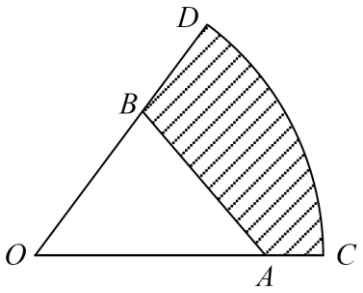
14. A car travels from A to B with speed 80 km/h. Then it travels from B to C with speed 96 km/h. The distance between A and B is 240 km while that between B and C is 480 km. Find the average speed of the car from A to C via B.

A. $85\dfrac{1}{3}$ km/h
B. 88 km/h
C. 90 km/h
D. $90\dfrac{2}{3}$ km/h

15. 

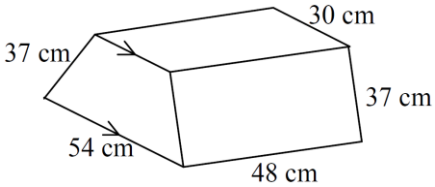
In the figure, *ABCD* is a parallelogram. *E* is the mid-point of *AD*. *EHGF*, *DGC*, *BHD* and *BCF* are straight lines. *BC* : *CF* = 4 : 1. If the area of Δ*EHD* is 24 cm^2, then the area of *AEHB* is

A. 100 cm^2 .
B. 120 cm^2 .
C. 144 cm^2 .
D. 150 cm^2 .

16. 

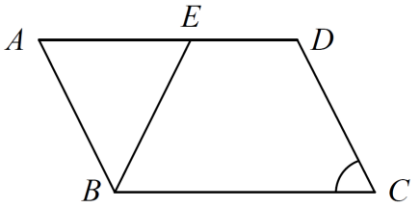
In the figure, OCD is a circular sector with centre *O*. $\angle AOB = 60°$. *OA* = 12 cm, *OB* = 8 cm and *AC* = 4 cm. Find the area of the shaded region correct to the nearest cm^2.

A. 50 cm^2
B. 51 cm^2
C. 92 cm^2
D. 93 cm^2

17. 

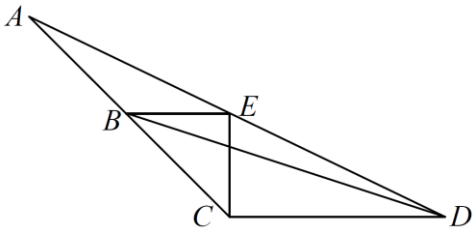
The figure shows a right prism. Find the volume of the prism.

A. 60480 cm^3
B. 70560 cm^3
C. 72576 cm^3
D. 74592 cm^3

18. 

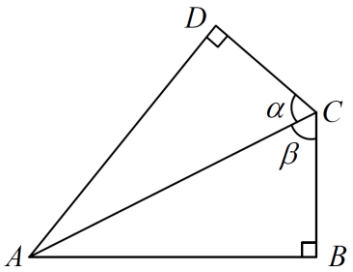
In the figure, *ABCD* is a parallelogram. *E* is a point lying on *AD* such that *AE* = *CD*. If $\angle BED = 132°$, then $\angle BCD =$

A. 48 °.
B. 72 °.
C. 84 °.
D. 96 °.

19. 

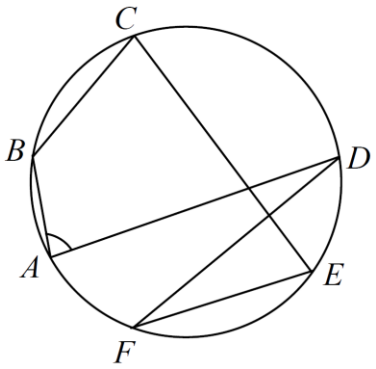
In the figure, *ABC* and *AED* are straight lines. $\angle BEC = 90°$ and *BE* is parallel to *CD*. *CE* = 24 cm, *BD* = 74 cm and *BC* = 40 cm. Find the area of Δ*ABE*.

A. 1664 cm^2
B. 2048 cm^2
C. 2432 cm^2
D. 3072 cm^2

20. 

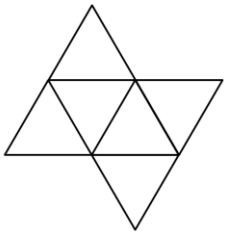
In the figure, *AB* =

A. $\frac{DC \sin \beta}{\cos \alpha}$.
B. $\frac{DC \sin \alpha}{\cos \beta}$.
C. $\frac{DC \cos \beta}{\sin \alpha}$.
D. $\frac{DC \cos \alpha}{\sin \beta}$.

21. 

In the figure, AD is parallel to FE. $\angle ADF = 32°$ and $\angle BCE = 81°$. Find $\angle BAD$.

A. $49°$
B. $67°$
C. $99°$
D. $113°$

22. 

The figure above consists of six identical equilateral triangles. The number of folds of rotational symmetry of the figure is

A. 2 .
B. 3 .
C. 4 .
D. 5 .

23. The straight line L: $ax - 8y + b = 0$ is perpendicular to the straight line $4x - 2y + c = 0$. What is the value of a?

A. –16
B. –4
C. 4
D. 16

24. Let P be a moving point in the rectangular coordinate plane such that the perpendicular distance from P to straight line $2x + 4y - 13 = 0$ is fixed. Which of the following may be the equation of locus of P?

A. $x + 2y - 16 = 0$ or $x + 2y + 3 = 0$
B. $x + 2y + 16 = 0$ or $x + 2y - 3 = 0$
C. $2x + y - 16 = 0$ or $2x + y + 3 = 0$
D. $2x + y + 16 = 0$ or $2x + y - 3 = 0$

25. The polar coordinates of the points P, Q and R are $(6, 85°)$, $(6, 205°)$ and $(6, 325°)$ repectively. Find the perimeter of ΔPQR.

A. $6\sqrt{3}$
B. $12\sqrt{3}$
C. $18\sqrt{3}$
D. $24\sqrt{3}$

26. The equation of the circle C is $4x^2 + 4y^2 - 12x + 16y - 39 = 0$. Which of the following are true?

I. The circumference of C is greater than 12π.
II. The centre of C lies on straight line $2x - 3y - 9 = 0$.
III. The origin lies inside C.

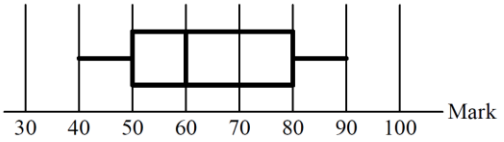
A. I and II only
B. I and III only
C. II and III only
D. I, II and III

27. Betty throws a fair die twice. Find the probability that the sum of the numbers she gets is greater than 5.

A. $\frac{5}{18}$
B. $\frac{5}{12}$
C. $\frac{7}{12}$
D. $\frac{13}{18}$

28. A bag contains three \$1 coins, four \$2 coins, two \$5 coins and one \$10 coin. Mary takes one coin randomly from the bag. Find the expected value of the coin.

A. \$2.6
B. \$3.1
C. \$3.7
D. \$4.5

29. 

The box-and-whisker diagram above shows the distribution of the Mathematics scores of a class of students. Which of the following are true?

I. mean = 60 marks
II. upper quartile = 80 marks
III. range = 50 marks

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

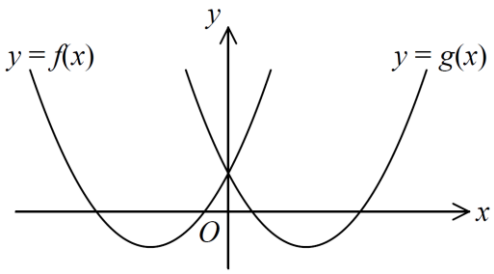
30. Consider the following positive integers.

2	4	5	6	10
12	14	15	a	b

If $a < b < 15$ and the median of the above data is 11, then the largest possible mean of the above data is

A. 9 .
B. 9.5 .
C. 9.7 .
D. 9.8 .

Section B

31. 

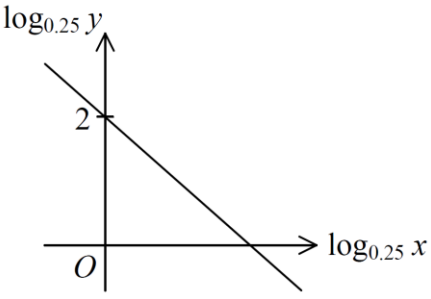
Let $f(x)$ and $g(x)$ be quadratic functions. The figure above shows the graph of $y = f(x)$ and $y = g(x)$. Which of the following may be the relation between $f(x)$ and $g(x)$?

I. $g(x) = f(-x)$
II. $g(x) = -f(x)$
III. $g(x) = f(x + a)$, where $a < 0$

A. I only
B. II only
C. I and III only
D. II and III only

32. $32^8 - 4^{19}$ =

A. $B00000000_{16}$.
B. $C00000000_{16}$.
C. $B000000000_{16}$.
D. $C000000000_{16}$.

33. 

The graph in the figure shows the linear relation between $\log_{0.25} y$ and $\log_{0.25} x$. If $y = kx^a$, then k =

A. $\frac{1}{16}$.
B. $\frac{1}{2}$.
C. 2 .
D. 16 .

34. Consider the following system of inequalities:

$$\begin{cases} x - 8 \le 0 \\ y - 9 \le 0 \\ 3x + 4y \le 24 \\ 3x + 4y \ge -12 \end{cases}$$

Let R be the region which represents the solution of the above system of inequalities. If (x, y) is a point lying in R, then the least value of $2x + 4y + 25$ is

A. –1 .
B. 5 .
C. 29 .
D. 41 .

35. A lunch supplier provides lunch boxes for a school. Each lunch box contains x units of Food A and y units of Food B. Their nutrition contents per unit are shown in the following table:

Food	Protein (g)	Fat (g)
A	9	4
B	3	5

Each lunch box should contain at least 45 g protein and less than 100 g fat. Which of the following are the constraints on x and y?

A. $\begin{cases} 9x + 4y \ge 45 \\ 3x + 5y < 100 \\ x \ge 0 \\ y \ge 0 \end{cases}$

B. $\begin{cases} 9x + 4y > 45 \\ 3x + 5y < 100 \\ x \ge 0 \\ y \ge 0 \end{cases}$

C. $\begin{cases} 3x + y \ge 15 \\ 4x + 5y < 100 \\ x \ge 0 \\ y \ge 0 \end{cases}$

D. $\begin{cases} 3x + y > 15 \\ 4x + 5y < 100 \\ x \ge 0 \\ y \ge 0 \end{cases}$

36. Let a_n be the n^{th} term of an arithmetic sequence. If $a_{10} = 71$ and $a_{15} = 46$, which of the following must be true?

I. The common difference of the sequence is 5.
II. The third term of the sequence is 106.
III. The sum of the first n terms of the sequence must be less than 1410.

A. I only
B. II only
C. I and III only
D. II and III only

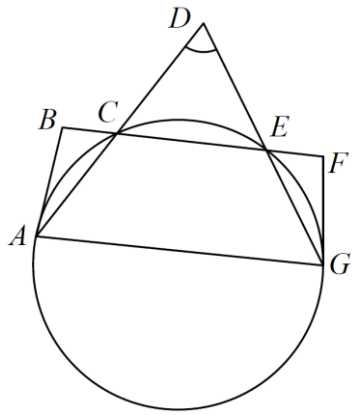
37. The imaginary part of $\dfrac{10i^{20} - 5i^{19}}{i^{14} + 2i^{15}}$ is

A. –4 .
B. –3 .
C. 3 .
D. 4 .

38. For $0° \le x < 360°$, how many roots does the equation $3\cos^2 x = 6 \sin x + 5$ have?

A. 2
B. 3
C. 4
D. 5

39.

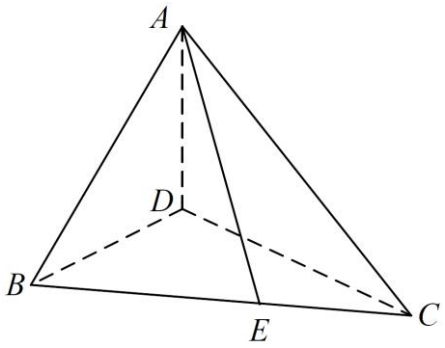


In the figure, AB and GF are tangents to the circle at A and G respectively. DA and DG intersect the circle at C and E respectively. $BCEF$ is a straight line. $\angle BAG = 65°$, $\angle ABF = 106°$ and $\angle FGE = 14°$. Find $\angle ADG$.

A. 55 °
B. 60 °
C. 78 °
D. 87 °

40. Let a be a non-zero constant. The straight lines L_1: $4x + 3y = a$ and L_2: $4x - 3y = a$ intersect the y-axis at P and Q respectively. L_1 and L_2 intersect at R. Let b be the x-coordinate of the circumcentre of ΔPQR. Find $\frac{a}{b}$.

A. $-\frac{72}{7}$
B. $-\frac{4}{3}$
C. $-\frac{3}{4}$
D. $-\frac{7}{12}$

41. 

In the figure. AD is perpendicular to plane BCD. E is a point on BC such that $BE = 80$ cm and $EC = 38$ cm. $AD = 20$ cm, $AB = 52$ cm and $DC = 99$ cm. Find the angle between AE and plane BCD correct to the nearest 0.1 °.

A. 16.9 °
B. 21.5 °
C. 26.4 °
D. 26.8 °

42. The number of students in Class 6A and Class 6B are 30 and 24 respectively. 4 students are selected randomly from the 2 classes to form a committee. If at least 1 student must be selected from each class, how many different committees can be formed?

A. 38031
B. 278220
C. 316251
D. 6677280

43. When Mary and Susan throw a dart, the probabilities that they hit the target are 0.6 and 0.8 respectively. Mary and Susan each throws the dart 3 times. Find the probability that Mary hits the target more than Susan.

A. $\frac{129}{15625}$
B. $\frac{153}{3125}$
C. $\frac{1749}{15625}$
D. $\frac{477}{3125}$

44. In a test, the mean of the test score is 50 marks. Both Amy and Betty got 50 marks. Mary got 70 marks. Amy and Betty leave the class for further studies. For the remaining students in the class, which of the following must remain unchanged?

I. Mean of the test score
II. Median of the test score
III. Mary's standard score

A. I only
B. III only
C. I and III only
D. I, II and III only

45. Let T_n be the n^{th} term of a geometric sequence with common ratio 3. If the variance of $\{T_1, T_2, T_3, T_4, T_5, T_6, T_7\}$ is 12, then the variance of $\{T_3, T_4, T_5, T_6, T_7, T_8, T_9\}$ is

A. 12 .
B. 36 .
C. 108 .
D. 972 .

End of Paper