S6 FINAL EXAM
MATH CP
PAPER 2

FINAL EXAMINATION 2021-2022

FORM SIX MATHEMATICS Compulsory Part
PAPER 2

11:15 am – 12:30 pm (1¼ hours), Feb., 2022

INSTRUCTIONS

1. Read carefully the instructions on the Answer Sheet and insert the information required in the spaces provided. No extra time will be given for inserting the information after the 'Time is up' announcement.
2. When told to open this book, you should check that all the questions are there. Look for the words **'END OF PAPER'** after the last question.
3. All questions carry equal marks.
4. **ANSWER ALL QUESTIONS**. You are advised to use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured.
5. You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.
6. No marks will be deducted for wrong answers.

There are 30 questions in Section A and 15 questions in Section B.
The diagrams in this paper are not necessarily drawn to scale.
Choose the best answer for each question.

Section A

1. $\dfrac{3^{14a}9^{3-2a}}{81^a} =$

   A. 27^{6a}.

   B. 27^{2a+2}.

   C. 27^{4a+3}.

   D. 27^{11a+3}.

2. Make b the subject of the formula $k = \dfrac{4}{ab} - \dfrac{1}{c}$.

   A. $b = \dfrac{4c}{a(kc+1)}$

   B. $b = \dfrac{4c}{a(kc-1)}$

   C. $b = \dfrac{4c}{a(1-kc)}$

   D. $b = \dfrac{c}{a(4-kc)}$

3. $(4p-2q)(3p+2q)+4(2p-q) =$

   A. $2(2p-q)(3p+2q+2)$.

   B. $2(2p+q)(3p-2q+2)$.

   C. $2(2p-q)(3p-2q-2)$.

   D. $2(2p+q)(3p-2q-2)$.

4. $\frac{2}{3a-2}-\frac{3}{3a+2}=$

A. $\frac{3a+2}{(2-3a)(3a+2)}$

B. $\frac{3a-10}{(2-3a)(3a+2)}$

C. $\frac{3a-10}{(3a-2)(3a+2)}$

D. $\frac{1}{(2-3a)(3a+2)}$

5. If $x = 10.0$ (correct to 1 decimal places) and $y = 5.2$ (correct to 2 significant figures) and, find the range of values of $x + y$.

A. $14.6 \le x + y < 15.8$

B. $14.6 < x + y \le 15.8$

C. $15.1 \le x + y < 15.3$

D. $15.1 < x + y \le 15.3$

6. If $f(x-1) = x^2 - 4$, then $f(x) + f(-x) =$

A. 8

B. $2x^2 - 4$

C. $2x^2 - 6$

D. $2x^2 - 8$

7. Let $p(x) = x^3 - ax^2 - 3$, where a is a non-zero constant. If $p(a) = a$, then $p(-a) =$

A. -51

B. -3

C. 3

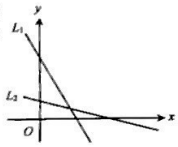
D. 51

8. In the figure, the equations of the straight lines L_1 and L_2 are $x - ay = b$ and $cx - 2y = d$ respectively. Which of the following are true?

I. $ac < 2$

II. $b < 0$

III. $ad < 2b$



A. I and II only

B. I and III only

C. II and III only

D. I, II and III

9. Which of the following about the graph of $y = -3(x-2)^2 - 5$ must be true?

A. The y-intercept is 5.

B. The graph has no x-intercepts.

C. The coordinates of the vertex are (2, 5).

D. The equation of the axis of symmetry is $x = -2$.

10. Suppose u varies as v and inversely as $\sqrt{w}$. If v is decreased by 20% and w is decreased by 36%,then u

A. is decreased by 77% (correct to the nearest integer).

B. is decreased by 19%.

C. is increased by 11% (correct to the nearest integer).

D. remains unchanged.

11. A sum of \$6000 is deposited in a bank at an interest rate 4% p.a. for 5 years, compounded quarterly. Find the interest correct to the nearest dollar.

A. \$1200

B. \$1300

C. \$1319

D. \$1321

12. Let a_n be the nth term of a sequence. If $a_2 = 10$, $a_5 = 34$ and $a_{n+2} = 2a_{n+1} - a_n$, then $a_3 =$

A. 2.

B. 7.

C. 18.

D. 26.

13. Let p, q and r be non-zero numbers. If $3p = 2r$ and $q : r = 3 : 4$, then $(p + 2q) : (2r - q) =$

A. 26 : 15.

B. 25 : 4.

C. 8 : 5.

D. 5 : 1.

14. Let $h(x)$ be a polynomial. $x + 3$ is a factor of $h(x)$. When $h(x)$ is divided by $x - 2$, the remainder is 10. Find the remainder when $p(x)$ is divided by $x^2 + x - 6$.

A. $2x + 6$

B. $2x - 6$

C. $-2x + 6$

D. $-2x - 6$

15. The solution of $5 + 2x \le -5$ or $\frac{1-x}{4} \ge 1$ is

A. $x \le -5$ or $x \ge -3$.

B. $-5 \le x \le -3$.

C. $x \le -3$.

D. $x \le -5$.

16. The ratio of the base radius and the height of a right cylinder is 4 : 3. The radius of a hemisphere is twice the base radius of the cylinder. Find the ratio of the total surface area of the cylinder to that of the hemisphere.

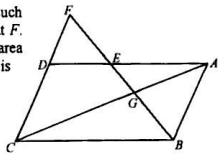
A. 9 : 64

B. 7 : 24

C. 4 : 9

D. 2 : 3

17. In the figure, $ABCD$ is a parallelogram. E is a point on AD such that $AE : ED = 3 : 2$. CD produced meets BE produced at F. Denote the point of intersection of AC and BE by G. If the area of $\triangle DEF$ is 32 cm^2, then the area of quadrilateral $CDEG$ is



A. 41 cm^2.

B. 62 cm^2.

C. 93 cm^2.

D. 114 cm^2.

18. Which of the following about a regular 18-sided polygon are true?

I. It has an 18-fold rotational symmetry.

II. The size of an exterior angle is 20°.

III. The polygon has 16 diagonals.

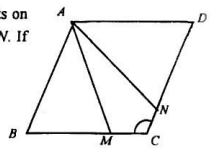
A. I and II only

B. I and III only

C. II and III only

D. I, II and III

19. In the figure, $ABCD$ is a parallelogram. M and N are points on BC and CD respectively such that $AB = AM$ and $AD = AN$. If $\angle MAN = 15°$, then $\angle BCD =$



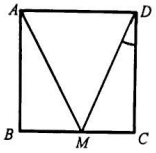
A. 105°.

B. 115°.

C. 130°.

D. 155°.

20. In the figure, $ABCD$ is a square. M is a point on BC such that $\angle AMB = 69°$. Find $\angle CDM$ correct to the nearest degree.



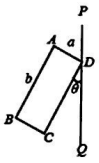
A. 21°

B. 26°

C. 29°

D. 32°

21. In the figure, PDQ is a straight line and $ABCD$ is a rectangle. Find the shortest distance from B to PQ.



A. $(a + b)\cos\theta$

B. $(a + b)\sin\theta$

C. $a\cos\theta + b\sin\theta$

D. $a\sin\theta + b\cos\theta$

22. The angle of a sector is decreased by 20% but its radius is increased by k%. If the arc length of the sector remains unchanged, find the value of k.

A. 11.8

B. 20

C. 25

D. 125

23. The polar coordinates of the points A, B and C are (2, 40°), (4, 70°) and (3, 220°) respectively. The area of $\triangle ABC$ is

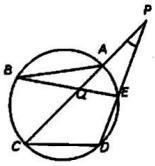
A. 2.

B. 4.

C. 5.

D. 10.

24. In the figure, AC is a diameter of the circle $ABCDE$. AC and BE intersect at Q. CA produced and DE produced meet at P. If $\angle ABE = 25°$ and $\angle ACD = 40°$, then $\angle CPD =$



A. 25°.

B. 28°.

C. 32°.

D. 35°.

25. The equation of the straight line L is $y = 6$. If P is a moving point in the rectangular coordinate plane such that the perpendicular distance from P to L is 8, then the locus of P is

A. a straight line.

B. a pair of parallel lines.

C. a circle.

D. a parabola.

26. The equation of the circle C is $2x^2 + 2y^2 - 6x + 12y - 135 = 0$. Which of the following about C is true?

A. The origin lies inside C.

B. The area of C is greater than 250.

C. The entire circle lies in the fourth quadrant.

D. The coordinates of the centre of C are $(3, -6)$.

27. The coordinates of the points A, B and C are (1, 2), (6, 5) and (10, 7) respectively. Find the equation of the straight line which passes through the centroid of ΔABC and A.

A. $4x - 7y + 10 = 0$

B. $4x + 7y - 16 = 0$

C. $7x - 4y + 1 = 0$

D. $7x + 4y - 15 = 0$

28. Two numbers are randomly drawn at the same time from ten cards numbered 3, 3, 3, 4, 4, 5, 6, 6, 6 and 6 respectively. Find the probability that the sum of the numbers drawn is 9.

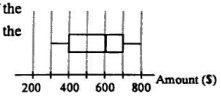
A. $\frac{4}{25}$

B. $\frac{7}{25}$

C. $\frac{7}{45}$

D. $\frac{14}{45}$

29. The box-and-whisker diagram below shows the distribution of the weekly amounts spent on food by a group of students. Find the inter-quartile range of the distribution.



A. $200

B. $300

C. $500

D. $600

30. Let X be a group of numbers $\{4, 4, 4, 4, 4, 4, 5, 5, 6, 6, 6, 9, k\}$, where k is an integer between 4 and 9 inclusive. Which of the following must be true?

I. Mean of X > median of X

II. Median of X > mode of X

III. Mode of X < mean of X

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

Section B

31. The H.C.F and the L.C.M. of three expressions are a^3b^4c and $a^6b^5c^5$ respectively. If the first and the second expression are a^3b^5c and $a^5b^5c^3$ respectively, then the third expression is

A. a^3b^5c.

B. $a^3b^5c^5$.

C. a^6b^4c.

D. $a^6b^4c^5$.

32. 1110100010101101101_2 =

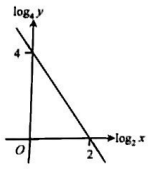
A. $14 \times 16^4 + 138 \times 16^2 + 14 \times 16^1 + 43$

B. $14 \times 16^4 + 138 \times 16^2 + 12 \times 16^1 + 45$

C. $14 \times 16^5 + 138 \times 16^3 + 14 \times 16^2 + 43$

D. $14 \times 16^5 + 138 \times 16^3 + 12 \times 16^2 + 45$

33. The graph in the figure shows the linear relation between $\log_2 x$ and $\log_4 y$. Which of the following must be true?



A. $x^4y = 256$

B. $x^2y = 256$

C. $x^4 + y = 256$

D. $x^2 + y = 256$

34. It is given that $\log_8 y$ is a linear function of $\log_4 x$. If the slope and the intercept on the horizontal axis of the graph of the linear function are 4 and 1 respectively, then

A. $y = \frac{x^{12}}{4096}$.

B. $y = \frac{x^6}{4096}$.

C. $y = \frac{x^{12}}{2048}$.

D. $y = \frac{x^6}{2048}$.

35. $(2+i^5)(1+2i^2-i^3)=$

A. $5-5i$.

B. $7-i$.

C. $-1+3i$.

D. $-3+i$.

36. Let x_n be the nth term of an arithmetic sequence. If $x_1=-3$, $x_k=72$ and the sum of the first k terms is 897, which of the following are true?

I. $k=26$

II. 0 is a term of the sequence.

III. The sum of the first $2n$ terms is $6n^2-6$.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

37. Consider the system of inequalities

$$\begin{cases} 3x+4y\le 120 \\ x-2y+10\ge 0 \\ y\ge 6 \\ x\ge 10 \end{cases}$$

Let D be the region which represents the solution of the above system of inequalities. If (x, y) is a point lying in D, then the greatest value of $2x+3y+20$ is

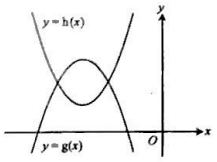
A. 96.

B. 98.

C. 102.

D. 105.

38. The figure shows the graphs of $y=g(x)$ and $y=h(x)$. Which of the following may be correct?



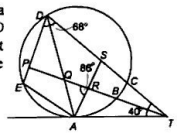
A. $h(x)=g(-x)-7$

B. $h(x)=g(-x)+7$

C. $h(x)=-g(x)-7$

D. $h(x)=-g(x)+7$

39. In the figure, AT is the tangent to the circle $BCDE$ at A. P is a point on DE. $PQRBT$ and AQD are angle bisectors of $\angle ATD$ and $\angle EDT$ respectively. ARS and $DSCT$ are straight lines. $\angle ATD=40°$, $\angle EDT=68°$ and $\angle QRA=86°$. Which of the following must be true?



I. A, E, P and Q are concyclic.

II. $\angle RAQ=\angle ATD$

III. ΔADS is congruent to ΔADE.

A. I and II only.

B. I and III only.

C. II and III only.

D. I, II and III.

40. If the straight line $x+2y-2=0$ and the circle $x^2+y^2-14x+10y+1=0$ intersect at the points M and N, then x-coordinate of the centre of the circle with MN as a diameter is

A. −15.

B. −3.

C. 8.

D. 12.

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

A. 1

B. 2

C. 3

D. 4

42. In an office, there are 30 male employees and 18 female employees. If 5 employees are selected from the office to form a group, how many different groups can be formed such that there are more male employees than female employees in the group?

A. 1 712 304

B. 1 256 976

C. 882 438

D. 621 180

43. Bag A contains 5 red balls and 4 green balls, while bag B contains 2 red balls and 5 green. Sammy randomly draws a ball from bag A and puts it into bag B. If she now randomly draws a ball from bag B, find the probability that a red ball is drawn.

A. $\frac{1}{4}$

B. $\frac{5}{18}$

C. $\frac{5}{24}$

D. $\frac{23}{72}$

44. The scores of a group of students in an examination are normally distributed and the standard deviation of the scores is 6 marks. It is given that half of the students get at least 65 marks. If the standard score of John in the examination is 1.5, find his score in the examination.

A. 56 marks

B. 62 marks

C. 68 marks

D. 74 marks

45. If the mean and the variance of a group of numbers $\{x_1, x_2, x_3, \cdots, x_9\}$ are m and v respectively, then the variance of the group of numbers $\{x_1, x_2, x_3, \cdots, x_9, m\}$ is

A. $\frac{9v}{10}$.

B. v.

C. $\frac{10v}{9}$.

D. $2v$.

END OF PAPER