MATH CP
PAPER 2

MC

福建中學

S6 Mock Examination (2021 – 2022)

Mathematics Compulsory Part

PAPER 2

(1 hour 15 minutes)

Date: 14th January 2022 Name:_____

Time: 11:15 a.m. – 12:30 p.m. Class: _____ No.: _____

INSTRUCTIONS

1. Read carefully the instructions on the Answer Sheet and insert the information required in the spaces provided.

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.

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. $\dfrac{(3^{2n})(16^{n})}{2^{2n}} =$

   A. 6^{-n}.

   B. 6^{n}.

   C. 6^{2n}.

   D. 6^{3n}.

2. If $p(2 - x) - x = -x(p + x)$, then $p =$

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

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

   C. $\dfrac{x + x^2}{2}$.

   D. $\dfrac{x}{1 - x}$.

3. $4 - 4u^2 - 12uv - 9v^2 =$

   A. $(2 + 2u + 3v)(2 - 2u - 3v)$.

   B. $(2 + 2u - 3v)(2 - 2u + 3v)$.

   C. $(4 + 4u + 3v)(1 - u - 3v)$.

   D. $(4 + 4u - 3v)(1 - u + 3v)$.

4. $\dfrac{1}{a+3b}-\dfrac{4}{3a-b}=$

A. $\dfrac{a+11b}{(a+3b)(b-3a)}$.

B. $\dfrac{a+13b}{(a+3b)(b-3a)}$.

C. $\dfrac{a-11b}{(a+3b)(b-3a)}$.

D. $\dfrac{a-13b}{(a+3b)(b-3a)}$.

5. The greatest integer satisfying the compound inequality $3-2(x-5)\geq 19$ or $\dfrac{4x+1}{3}<6$ is

A. -3.

B. -2.

C. 3.

D. 4.

6. If A, B and C are non-zero constants such that $A(x+4)+B(2x+1)\equiv C(x+3)$, then $A:B=$

A. 1 : 5.

B. 1 : 7.

C. 5 : 1.

D. 7 : 1.

7. Let $f(x)=2x^2-x-3$. If α is a constant, then $f(1+\alpha)-f(1-\alpha)=$

A. 2α.

B. 6α.

C. $4\alpha^2-4$.

D. $4\alpha^2-2\alpha-3$.

8. Let $f(x)$ be a polynomial divisible by $x + 2$. When $f(x)$ is divided by $x - 2$, the remainder is 4.

   Find the remainder when $f(x)$ is divided by $x^2 - 4$.

   A. $-x - 2$

   B. $-x + 2$

   C. $x - 2$

   D. $x + 2$

9. In a marathon race, 40% of the runners are above 25 years old. If 70% of the female runners and 30% of the male runners are above 25 years old, find the percentage of male runners in the race.

   A. 25%

   B. 50%

   C. 60%

   D. 75%

10. The volume of a carton of milk is measured as 1.8 L correct to the nearest 0.1 L. If the carton of milk is poured into n bottles such that the volume of each bottle of milk is measured as 80 mL correct to the nearest 10 mL, find the greatest possible value of n.

    A. 22

    B. 23

    C. 24

    D. 25

11. If $x : y = 2 : 3$ and $y : z = 1 : 4$, then $(x + y):(y + z) =$

    A. 1 : 3.

    B. 2 : 1.

    C. 1 : 1.

    D. 3 : 4.

12. It is given that w varies directly as x and inversely as the square root of y. If x is decreased by 16% and y is increased by 44%, then w

A. is increased by 23%.

B. is decreased by 30%.

C. is decreased by 40%.

D. is decreased by 70%.

13. Let x_n be the nth term of a sequence. If $x_2 = 4$, $x_5 = 34$ and $x_{n+2} = x_{n+1} + x_n$ for any positive integer n, then $x_6 =$

A. 38.

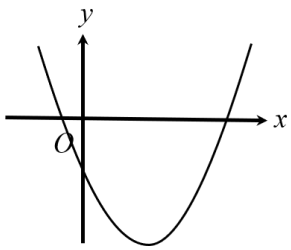
B. 44.

C. 53.

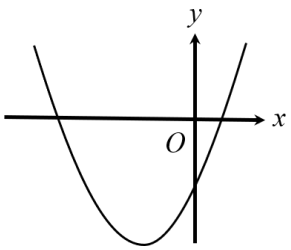
D. 64.

14. Let h and k be constants. If $h > 0$ and $k < 0$, which of the following can be the graph of $y = h(k - x)^2 - 1$?

A.



B.



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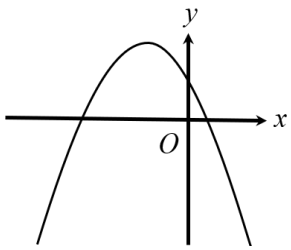
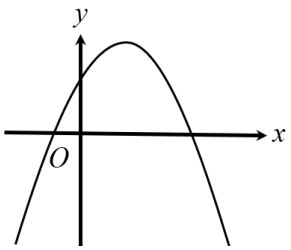


D.



15. The base of a solid right prism is an equilateral triangle. All the lateral faces of the prism are squares. If the volume of the prism is 486 cm^3, find the total surface area of the prism correct to the nearest cm^2.

A. 263 cm^2

B. 322 cm^2

C. 371 cm^2

D. 418 cm^2

16. A container is full of water. 3 spherical metal balls are put into the container. When the metal balls are completely immersed into water, 252 cm^3 of water overflows. It is known that the ratio of the surface areas of the 3 metal balls are 1 : 4 : 9. Find the volume of the largest metal ball.

A. 189 cm^3

B. 210 cm^3

C. 126 cm^3

D. 162 cm^3

17. The angle of a sector is decreased by 75% but its radius is increased by 300%. Denote the arc lengths of the original sector and the new sector by a_1 and a_2 respectively. Which of the following is true?

A. $a_1 < a_2$

B. $a_1 = a_2$

C. $a_1 > a_2$

D. Cannot be determined

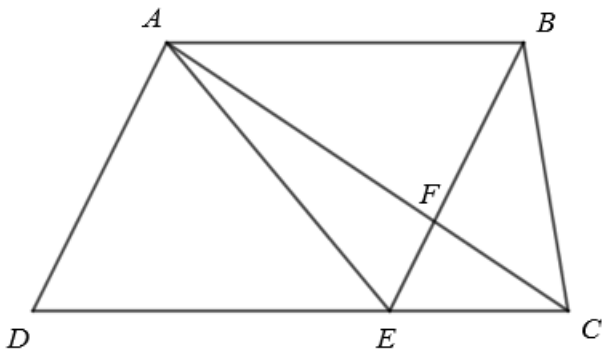
18. In the figure, *ABCD* is a trapezium. *E* is a point lying on *DC* such that *ABED* is a parallelogram and *AB* : *EC* = 2 : 1. *BE* and *AC* intersect at *F*. The ratio of the area of $\triangle FEC$ to the area of $\triangle ADE$ is

A. 1 : 3.

B. 1 : 4.

C. 1 : 6.

D. 1 : 8.

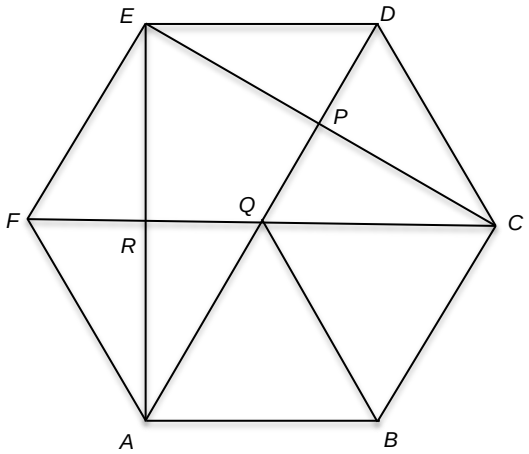


19. In the figure, *ABCDEF* is a regular hexagon. *AD* intersects *CE* and *CF* at *P* and *Q* respectively, while *AE* intersects *CF* at *R*. Which of the following are true?

I. $BQ = BC$

II. $\angle PQR + \angle PER = 180°$

III. $\Delta CDP \sim \Delta CER$



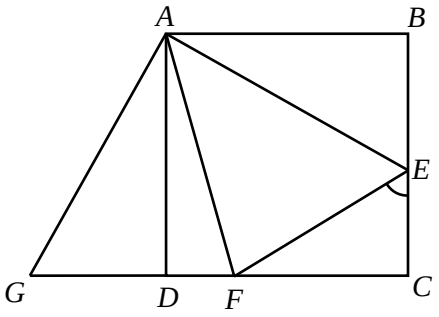
A. I and II only

B. I and III only

C. II and III only

D. I, II and III

20. In the figure, *ABCD* is a square. *CD* is produced to *G* such that $\angle DAG = 36°$. *E* is a point lying on *BC* such that *BE* = *DG*. If *F* is a point lying on *CD* such that $\angle DAF = 9°$, then $\angle CEF =$



A. 54°.

B. 63°.

C. 72°.

D. 81°.

21. If *ABCDE* is a regular pentagon, which of the following are true?

I. *AC* // *ED*

II. *BD* = *CE*

III. $2\angle BAD = 3\angle BCD$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

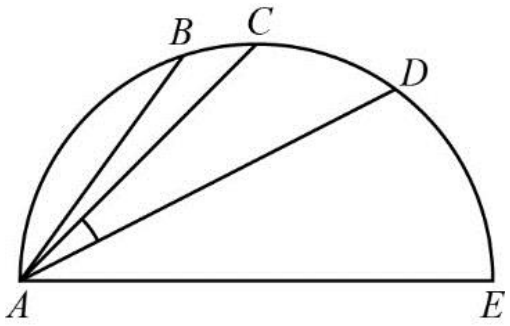
22. In the figure, $ABCDE$ is a semi-circle where $AB:BC:CD:DE=4:1:2:3$. Find $\angle CAD$.

A. 9°

B. 18°

C. 27°

D. 36°



23. A point P is translated upwards by 2 units to the point Q. Then, Q is rotated clockwise about the origin through 90° to the point R. If the coordinates of R are $(3\ ,\ \sqrt{3}\ )$, then the polar coordinates of P are

A. $(2\ ,\ 150°)$.

B. $(2\sqrt{3}\ ,\ 150°)$.

C. $(2\ ,\ 330°)$.

D. $(2\sqrt{3}\ ,\ 330°)$.

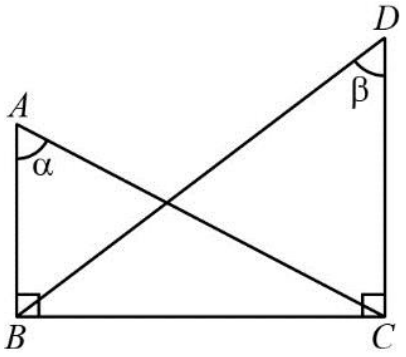
24. In the figure, $\dfrac{AB}{BD}=$

A. $\dfrac{\tan\beta}{\cos\alpha}$.

B. $\dfrac{\tan\alpha}{\sin\beta}$.

C. $\dfrac{\cos\beta}{\tan\alpha}$.

D. $\dfrac{\sin\beta}{\tan\alpha}$.



25. The coordinates of the points A and B are (4 , 7) and (5 , −2) respectively, and O is the origin. If P is a moving point in the rectangular coordinate plane such that the perpendicular distance from P to the straight line OA is equal to the perpendicular distance from P to the straight line OB, then the locus of P is

A. the perpendicular bisector of AB.

B. the angle bisector of $\angle AOB$.

C. the straight line which passes through A and B.

D. the circle with AB as a diameter.

26. The coordinates of the points A and B are (3 , 7) and (20 , 8) respectively. Let P be a point such that AP is an altitude of $\triangle OAB$, where O is the origin. Find the equation of the straight line which passes through A and P.

A. $2x - 5y - 41 = 0$

B. $2x - 5y + 29 = 0$

C. $5x + 2y - 1 = 0$

D. $5x + 2y - 29 = 0$

27. The equations of the straight line L and the circle C are $kx - 5y + k = 0$ and $2x^2 + 2y^2 - 8x - 12y + 15 = 0$ respectively, where k is a constant. If L divides C into two equal parts, find the y-intercept of L.

A. -1

B. 1

C. $\frac{6}{5}$

D. 5

28. A bag contains five cards A, B, C, D and E. Two cards are drawn at random from the bag one by one without replacement. Find the probability that card C is not drawn.

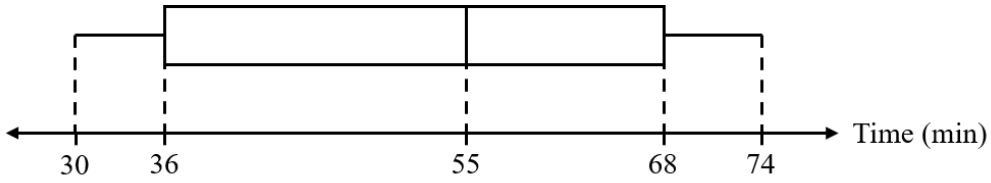
A. $\frac{1}{5}$

B. $\frac{2}{5}$

C. $\frac{3}{5}$

D. $\frac{4}{5}$

29. The box-and-whisker diagram below shows the distribution of the time (in minutes) spent on revision by students in Class 6A on a certain day.



Which of the following must be true?

I. The range of the distribution is 44 minutes.

II. At least half of the students in Class 6A spend more than 55 minutes on revision on that day.

III. If a student is randomly chosen from Class 6A, the probability that he/she spends 68 minutes or above on revision on that day is 0.25.

A. I only

B. III only

C. I and II only

D. II and III only

30. Consider the following integers:

22 35 26 42 37 22 p q r

If the mean and the mode of the above integers are 30 and 37 respectively, then the median of the above integers is

A. 12.

B. 22.

C. 35.

D. 37.

Section B

31. 11000000101_{16} =

A. $2^{10} + 2^9 + 5$.

B. $2^{11} + 2^{10} + 10$.

C. $2^{40} + 2^{36} + 257$.

D. $2^{44} + 2^{40} + 4\,112$.

32. Let a, b and c be positive constants. If $\log_a 2 = \log_b 5 = \frac{1}{c}$, then $\log_{ab} 10$ =

A. $\frac{1}{c^2}$.

B. $\frac{1}{c}$.

C. c^2.

D. c.

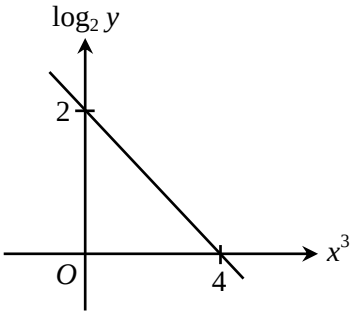
33. The graph in the figure shows the linear relation between x^3 and $\log_2 y$. If $x = -2$, then y =

A. 6.

B. 8.

C. 36.

D. 64.



34. Let a and b be real numbers. Define $u = a + bi$ and $v = a - bi$. If $a^2 + b^2 = 1$, which of the following must be true?

I. uv is a real number.

II. $v = \frac{1}{u}$.

III. u and v are the roots of the equation $x^2 - 2ax + 1 = 0$.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

35. Consider the following system of inequalities:

$$\begin{cases} 3x + 4y - 32 \le 0 \\ 2x + 5y - 26 \le 0 \\ x \ge 0 \\ y \ge 0 \end{cases}$$

Let R be the region which represents the solution of the above system of inequalities. Find the constant k such that the greatest value of $7x + 12y + k$ is 55, where (x, y) is a point lying in R.

A. –25

B. –4

C. 15

D. 27

36. If x_1, x_2, x_3, x_4, x_5, x_6, x_7 and x_8 form an arithmetic sequence of positive numbers, which of the following must be true?

I. $x_1 + x_3 + x_7 = x_2 + x_4 + x_5$

II. $x_5 - x_3 < x_8 - x_2$

III. $x_4 x_6 = x_3 x_7$

A. I only

B. III only

C. I and II only

D. II and III only

37. Let c be a constant. Find the range of values of c such that $-x^2 - 2cx + c - 20 \le 0$ for any real number x.

A. $-5 \le c \le 4$

B. $-4 \le c \le 5$

C. $c \le -5$ *or* $c \ge 4$

D. $c \le -4$ *or* $c \ge 5$

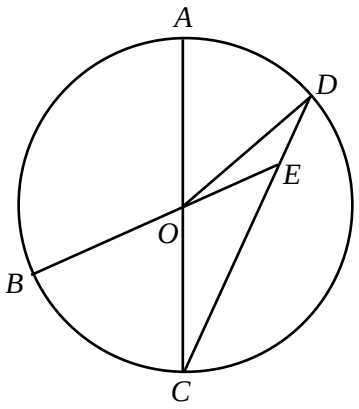
38. The figure shows a circle with radius 6 cm. O is the centre. Let A, B, C and D be points on the circle such that AOC is a straight line, $\angle AOD = 45°$ and $\angle AOB = 120°$. Denote the point of intersection of BO produced and CD by E. Find OE correct to the nearest 0.1 cm.

A. 3.4 cm

B. 3.6 cm

C. 3.8 cm

D. 4.0 cm



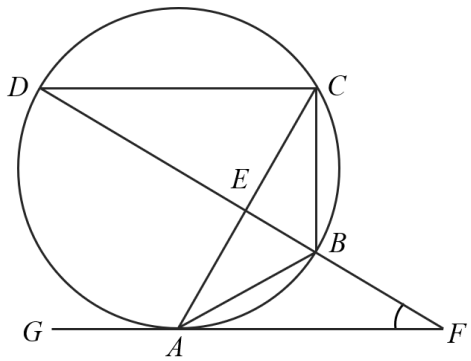
39. In the figure, $ABCD$ is a circle. DB is a diameter of the circle. FAG is the tangent to the circle at A. AC meets DB at E. DB produced meets FG at F. $\angle BAF = 25°$. Find $\angle BFA$.

A. 25°

B. 30°

C. 35°

D. 40°



40. If the straight line $x+y=0$ and the circle $x^2+y^2-2kx-8y+k=0$ intersect at two distinct points, find the range of values of *k*.

A. $-8<k<-2$

B. $k<-8$ or $k>-2$

C. $k<2$ or $k>8$

D. $2<k<8$

41. The equations of the three sides of a triangle are $12x + 5y = 60$, $12x - 5y = 60$ and $x = c$, where c is a constant. If the x-coordinate of the in-centre of the triangle is 18, then $c =$

A. 18.

B. 30.

C. 31.

D. 36.

42. A queue is formed by 6 adults and 3 children. If there is no child at either end of the queue and none of the children stands next to one another, how many different queues can be formed?

A. 43 200

B. 86 400

C. 151 200

D. 332 640

43. In a bag, there are 5 red balls and 1 green ball. Clement and Diana take turns to draw a ball at random from the bag without replacement until a green ball is drawn. The person who gets the green ball is the winner. If Clement draws first, find the probability that Clement will win at his second draw.

A. $\frac{1}{3}$

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

C. $\frac{1}{5}$

D. $\frac{1}{6}$

44. In a test, the test score of Lily is 45 marks and her standard score is –1.5. The test score of Henry is 70 marks and his standard score is 1. Find the standard deviation of the test scores.

A. 5 marks
B. 10 marks
C. 15 marks
D. 60 marks

45. It is given that $T(n)$ is the nth term of an arithmetic sequence. Which of the following must be true?

I. The mean of $\{T(2), T(3), T(4), \ldots, T(99)\}$ = The mean of $\{T(1), T(2), T(3), \ldots, T(100)\}$

II. The variance of $\{T(4), T(8), T(12), \ldots, T(100)\}$ = $\frac{1}{5}\times$ The variance of $\{T(20), T(40), T(60), \ldots, T(500)\}$

III. The range of $\{T(1), T(3), T(5), \ldots, T(2021)\}$ = The range of $\{T(2), T(4), T(6), \ldots, T(2022)\}$

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

END OF PAPER