SY F4 2022-2023 First Exam Paper two

22-23 FIRST EXAM
F.4 MATH CP
PAPER 2

School SY

FIRST TERM EXAMINATION 2022 – 2023

F.4 MATHEMATICS Compulsory Part
PAPER 2

10:30 am – 11:30 am (1 hour)

INSTRUCTIONS

1. Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should insert the information required in the spaces provided. No extra time will be given for filling the information after the 'Time is up' announcement.

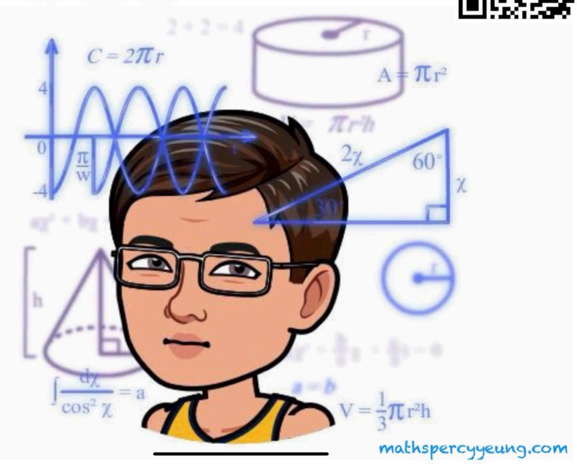
2. When told to open this book, you should check that all the questions are there. Look for the words '**END OF PAPER**' after the last question.

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 answer 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 36 questions.

The diagrams in this paper are not necessarily drawn to scale.

Choose the best answer for each question.

1. $\dfrac{(m^9)^6}{m^3} =$

A. m^5 .
B. m^{12} .
C. m^{18} .
D. m^{51} .

2. If $a(x+1) = b(x-1)$, then $x =$

A. $\dfrac{a-b}{a+b}$.
B. $\dfrac{b-a}{a+b}$.
C. $\dfrac{a+b}{a-b}$.
D. $\dfrac{a+b}{b-a}$.

3. If s is a positive irrational number, which of the following numbers must be an irrational number?

A. $\sqrt{s}$
B. s^3
C. $s+\sqrt{2}$
D. $\sqrt{2}s$

4. $2m^2 - 5mn + 2n^2 - 2m + n =$

A. $(2m - n)(m - 2n - 1)$.
B. $(2m - n)(m + 2n - 1)$.
C. $(2m + n)(m - 2n - 1)$.
D. $(2m + n)(m - 2n + 1)$.

5. $\dfrac{1}{x+2} - \dfrac{1}{3x-2} =$

A. $\dfrac{1}{(x+2)(3x-2)}$.
B. $\dfrac{2(x-2)}{(x+2)(3x-2)}$.
C. $\dfrac{2x}{(x+2)(3x-2)}$.
D. $\dfrac{2x-1}{(x+2)(3x-2)}$.

6. Let $z = \dfrac{6+ai}{2+3i}$, where a is a real number. If z is a purely imaginary number, then $a =$

A. -4 .
B. -2 .
C. 3 .
D. 9 .

7. How many distinct real roots are there for the equation $x^2 + (7 - x)^2 = 7^2$?

A. 0
B. 1
C. 2
D. Infinitely many

8. It is known that P(x) is a polynomial that is divisible by $x + 3$, find the remainder when P(x) is divided by $2x + 6$.

A. -3 B. 0 C. 2 D. 3

9. The G.C.D. of $4a^2b^3$ and $2ab^4$ is

A. $2ab$. B. $2ab^3$. C. $4a^2b^4$. D. $4a^3b^7$.

10. The L.C.M. of $x^2 + 2x$ and $x^2 + 4x + 4$ is

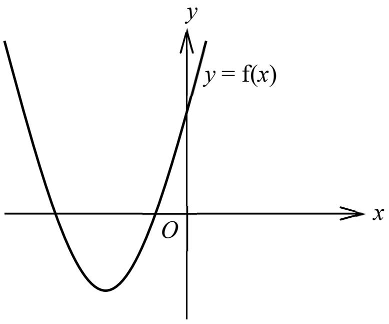
A. $x^3 + 4x$.
B. $x^3 + 4x^2 + 4x$.
C. $x^4 + 6x^3 + 12x^2 + 8x$.
D. $x^4 + 8x$.

11. Find the constant k such that the straight lines $2x + 3y + k = 0$ and $6x + ky + 12 = 0$ do not intersect.

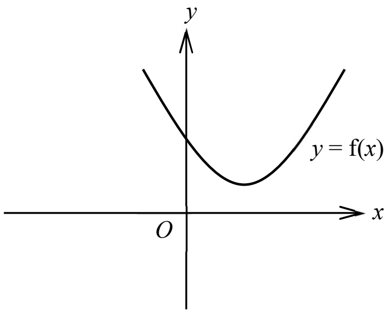
A. -4 B. 4 C. 6 D. 9

12. It is given that $f(x)$ is a quadratic function and the roots of $f(x) = 0$ are positive. Which of the following may represent the graph of $y = f(x)$?

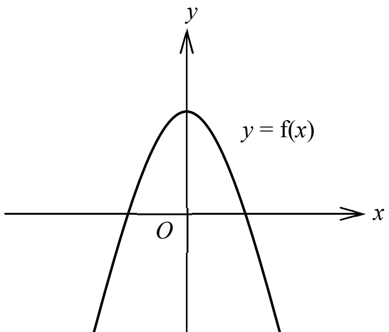
A.



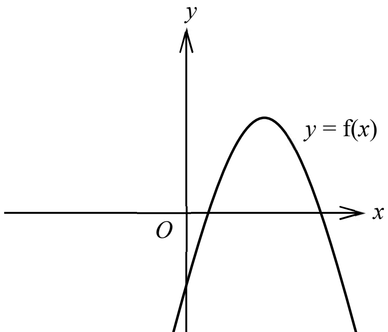
B.



C.



D.



13. If $x^2 - 2x + 1 = (mx)^2$ where $m > 1$, then $x =$

A. $\dfrac{1}{1-m}$.

B. $\dfrac{-1}{1+m}$ or $\dfrac{1}{1-m}$.

C. $\dfrac{1}{1+m}$ or $\dfrac{1}{1-m}$.

D. $\dfrac{1}{m-1}$ or $\dfrac{1}{1-m}$.

14. $\dfrac{x^4 + 2x^2 + 9}{x^2 + 2x + 3} =$

A. $x^2 - 2x + 3$.

B. $x^2 - x + 3$.

C. $x^2 + 3$.

D. $x^2 + x + 3$.

15. Let $g(x) = \sqrt{ax+b}$ where a and b are constants. If $g(2) = 3$, $g(6) = 5$ and $g(t) = 7$, then $t =$

A. 8 .

B. 10 .

C. 11 .

D. 12 .

16. Let $x^2 + bx = 1$, then $x =$

A. $\dfrac{-b \pm \sqrt{b^2 - 4}}{2}$.

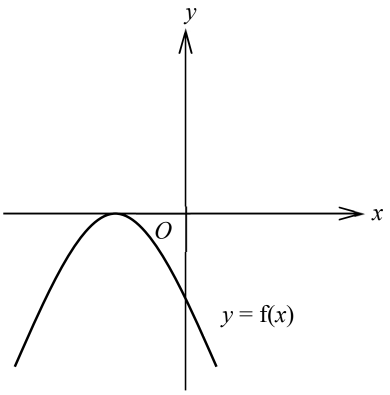
B. $\dfrac{-b \pm \sqrt{b^2 + 4}}{2}$.

C. $\dfrac{-b \pm \sqrt{b^2 - 1}}{2}$.

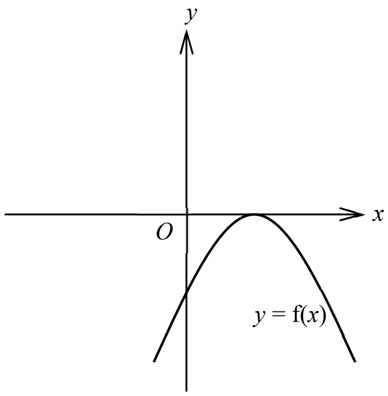
D. $\dfrac{-b \pm \sqrt{b^2 + 1}}{2}$.

17. Let $f(x)$ be a quadratic function such that the axis of symmetry of the graph of $y = f(x)$ is $x + 2 = 0$ and the graph of $y = f(x)$ opens upwards. Which of the following may represent the graph of $y = f(x)$?

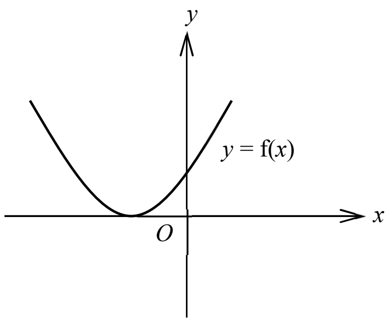
A.



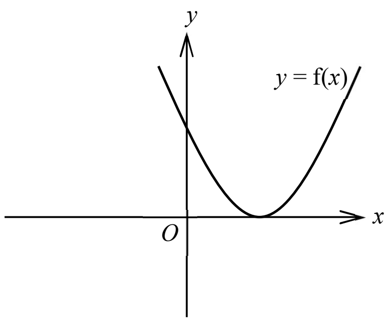
B.



C.



D.



18. $ai^{2023} - ai^{2025} =$

A. $-2a$.　　B. $2a$.　　C. $-2ai$.　　D. $2ai$.

19. Let $\mathrm{f}(x) = 4 - x^2$. The graph of $y = \mathrm{f}(x)$ intersects the x-axis at A and B, and the graph intersects the y-axis at C . Find the area of ΔABC .

A. 4　　B. 8　　C. 16　　D. 32

20. Let k be a non-zero constant. The x-intercept and y-intercept of the straight line L are k and $2k$ respectively. If L passes through $(2, 1)$, then $k =$

A. $\frac{2}{3}$.　　B. $\frac{4}{3}$.　　C. 2 .　　D. $\frac{5}{2}$.

21. Let $\mathrm{f}(x)$ be a function, which of the following statement(s) must be true?

I. If $\mathrm{f}(a) = \mathrm{f}(b)$ then $a = b$.
II. If $\mathrm{f}(a) = b$ then $\mathrm{f}(b) = a$.

A. none of the above　　B. I only　　C. II only　　D. both of them

22. The coordinates of the points A , B and C are $(1, 1)$, $(4, 5)$ and $(16, 1)$ respectively. Let P be a point such that AP is an altitude of ΔABC . Find the equation of the straight line which passes through A and P .

A. $2x - y - 1 = 0$　　B. $3x - y - 2 = 0$　　C. $2x - 9y + 7 = 0$　　D. $2x - 3y + 1 = 0$

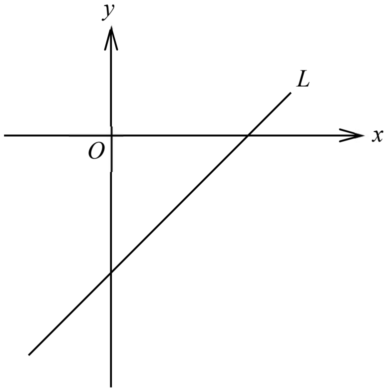
23. If α and β are the roots of the quadratic equation $x^2 + px + q = 0$, where p and q are real constants, then the equation with roots 2α and 2β is

A. $4x^2 + 2px + q = 0$.
B. $2x^2 + 2px + q = 0$.
C. $x^2 + 2px + 2q = 0$.
D. $x^2 + 2px + 4q = 0$.

24. If $\mathrm{f}(x) = \frac{1}{x+1}$, then $\mathrm{f}\left(\frac{1}{a+1}\right) =$

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

25. In the figure, the equation of the straight line L is $x + py = q$. Which of the following must be true?



I. $p < -1$

II. $pq < 0$

A. none of the above

B. I only

C. II only

D. both of them

26. The coordinates of the point P are (3, 4) . If P is rotated anticlockwise about the origin through 90° to the point Q , then equation of the line passing through PQ is

A. $x = 3$. B. $y = 4$. C. $x - 7y + 25 = 0$. D. $7x + y - 25 = 0$.

27. The equations of the straight lines L_1 and L_2 are $x - py + 8 = 0$ and $px - y + 1 = 0$ respectively. If L_1 and L_2 intersect at the point $(2 , q)$, where q is a positive constant, then $q =$

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

28. Let $z = (a+i)(3+bi)+(b+i)(3+ai)$, where a and b are real numbers. If z is a real number, which of the following must be true?

I. $a + b = 0$

II. $ab = -3$

A. none of the above B. I only C. II only D. both of them

29. If $f(x) = 2x^2 - 12x + 16$, which of the following must be true?

I. $f(x) = (2x - 3)^2 + 7$

II. $f(x) = (x - 2)(x - 4)$

A. none of the above B. I only C. II only D. both of them

30. Let u and v be real numbers, then the minimum value of $u^2 + 2u + 3v^2 + 4v + 5$ is

A. $\frac{8}{3}$. B. 4 . C. 5 . D. $\frac{22}{3}$.

31. If α is a root of the equation $x^2 + bx + 1 = 0$ where b is a constant, then $\alpha^2 + \frac{1}{\alpha^2} =$

A. b^2 . B. $2b^2$. C. $b^2 - 2$. D. $2b^2 - 2$.

32. Let c and k be constants such that $3x + k$ is a factor of $3x^3 + 3x^2 + kx + c$, which of the following must be true?

A. $k^2 = 3c$ B. $k^2 = 9c$ C. $k^3 = 3c$ D. $k^3 = 9c$

33. If the equation $px^2 + qx + 1 = 0$ has exactly two distinct positive real roots, then

A. $pq > 0$ and $q^2 > 4p$.
B. $pq < 0$ and $q^2 > 4p$.
C. $pq < 0$ and $q^2 < 4p$.
D. $pq > 0$ and $q^2 < 4p$.

34. The sum of the perimeter of a square and the circumference of a circle is 100 cm . Find the minimum total area of them correct to the nearest cm^2 .

A. 350 cm^2 B. 351 cm^2 C. 355 cm^2 D. 392 cm^2

35. Let O be the origin. The coordinates of the point P and Q are $(0, 48)$ and $(k , 24)$ respectively, where $k > 0$. If the x-coordinate of the circumcentre of ΔOPQ is 32, then $k =$

A. 7 . B. 18 . C. 72 . D. 96 .

36. Let $\mathrm{F}(x) = a(a+3)x^2 + 4(a+3)x + a^2$, where a is a constant. It is known that the greatest value of $\mathrm{F}(x)$ is 9 . The sum of all possible values of a is

A. -4 . B. -1 . C. 0 . D. 3 .

End of Paper