Secondary 4 Mathematics 1st Term Pre-exam
Multiple-choice Questions

Time allowed: 1 hour

Total Mark: 54

Instructions:

1. *ANSWER ALL QUESTIONS. All answers should be marked on the Answer Sheet.*
2. *Note that you may only mark ONE answer to each question. Two or more answers will score no marks.*
3. *All questions carry equal marks. No marks will be deducted for wrong answers.*
4. *The diagrams in this paper are not necessarily drawn to scale.*

1. If $5^{3m+1} = 5^{3m+2} - 100$, then $m =$

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

   B. $-\frac{1}{2}$.

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

   D. $\frac{1}{2}$.

   E. 1.

2. If the parabola $y = x^2 - x - 2$ and the line $y = x + 1$ intersect at the points (x_1, y_1) and (x_2, y_2), then x_1 and x_2 are the roots of the equation

   A. $x^2 - 3 = 0$.

   B. $x^2 - 2x - 3 = 0$.

   C. $x^2 + 2x + 3 = 0$.

   D. $x^2 - 2x = 0$.

   E. $x^2 + 2x = 3$.

3. Solve the equation $5 + y = \sqrt{1 - y}$.

   A. -8

   B. -3

   C. -3 *or* -8

   D. 3 *or* 8

   E. no real roots

4. $(a+b)^2(a^{-1}-b^{-1})^2 =$

A. $a^2 - b^2$

B. $\frac{a^2}{b^2} + \frac{b^2}{a^2}$

C. $\frac{b^2}{a^2} + \frac{a^2}{b^2} - 2$

D. 4

E. 0

5. If log 2 = a and log 9 = b, then log 108 =

A. $2a + 3b$.

B. $2a + \frac{3}{2}b$.

C. $\frac{3}{2}a + \frac{2}{3}b$.

D. $a^2 + b^{\frac{3}{2}}$.

E. $a^2 b^{\frac{3}{2}}$.

6. The equation of the line of symmetry of the graph of $y = a(x + h)^2 - k$ is

A. $x = h$.

B. $x = -h$.

C. $x = \frac{h}{a}$.

D. $x = k$.

E. $x = -k$.

7. Which of the following numbers is/are irrational?

I. 1.414 213 562

II. $1.\dot{4}1\dot{4}$

III. $\sqrt{2} + \sqrt{2}$

IV. $\sqrt{2} \times \sqrt{2}$

A. I only

B. II only

C. III only

D. I and II only

E. I, II and IV only

8. Given that $\sqrt{a} = 2 - \frac{1}{\sqrt{a}}$, find the value of $a + \frac{1}{a}$.

A. –2
B. –1
C. 0
D. 1
E. 2

9. Simplify $2\sqrt{3} + \frac{1}{\sqrt{3}+2} - \frac{1}{2-\sqrt{3}}$.

A. 1
B. $2\sqrt{3}$
C. $\sqrt{3} + \sqrt{2}$
D. 0
E. $\sqrt{3}$

10. *a*, *b* and *c* are three consecutive positive integers. Which of the following must be true?

A. *abc* must be odd.
B. *ab* must be even.
C. *ac* must be odd.
D. $a^2 + b^2$ must be even.
E. $a^2 + c^2$ must be odd.

11. If p and q are the roots of the equation $x^2 - 3x - 5 = 0$, then $(3^{p+1})(3^{q-2}) =$

A. 9.

B. 27.

C. 81.

D. $\frac{1}{9}$.

E. $\frac{1}{27}$.

12. If $y^4 - 8y^2 - 105 = 0$, then $y =$

A. $\sqrt{7}\ or -\sqrt{7}\ or \sqrt{15}\ or -\sqrt{15}.$

B. $\sqrt{2}\ or\ -\sqrt{2}\ or \sqrt{10}\ or\ -\sqrt{10}.$

C. $\sqrt{7}\ or\ -\sqrt{7}.$

D. $\sqrt{15}\ or\ -\sqrt{15}.$

E. $\sqrt{10}\ or\ -\sqrt{10}.$

13. If $\sqrt{2}\ (\sqrt{3}x + \sqrt{2}) = 3 + 2x$, then $x =$

A. $\sqrt{6} + 2$.

B. $\sqrt{6} - 2$.

C. $\frac{\sqrt{6}+2}{2}$.

D. $\frac{\sqrt{6}-2}{2}$.

E. $\frac{\sqrt{6}}{2} + 2$.

14. If the simultaneous equations

$$\begin{cases} y = ax^2 + bx + c \\ y = mx + n \end{cases}$$

have only one solution, which of the following must be true?
(*a, b, c, m and n are non-zero constants.*)

A. $(b + m)^2 = 4c(a - n)$

B. $(b - m)^2 = 4a(c - n)$

C. $b^2 = 4ac$

D. $(b + m)^2 = 4a(c + n)$

E. $(b + m)^2 = 4a(n - c)$

15. Simplify the expression $\frac{\sqrt{3}-2}{\sqrt{3}+2}-\frac{\sqrt{3}+2}{\sqrt{3}-2}$.

A. $-2\sqrt{2}$

B. 0

C. 1

D. $4\sqrt{3}$

E. $8\sqrt{3}$

16. $8x^6 + x^{-6} =$

A. $\left(x^2+\frac{1}{x}\right)\left(4x^4-2+\frac{1}{x^4}\right)$

B. $\left(x^2-\frac{1}{x}\right)\left(4x^4+1+\frac{1}{x^4}\right)$

C. $\left(2x^2-\frac{1}{x}\right)\left(4x^4+2+\frac{1}{x^2}\right)$

D. $\left(2x^2+\frac{1}{x^2}\right)\left(4x^4-2+\frac{1}{x^4}\right)$

E. $\left(2x^2+\frac{1}{x^2}\right)\left(4x^2-2+\frac{1}{x^2}\right)$

17. If $g(x)=x+\frac{1}{x}$, then $g(x)\cdot g\left(\frac{1}{x}\right) =$

A. 0.

B. 1.

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

D. $2x+\frac{1}{x}$.

E. $x^2+\frac{1}{x^2}+2$.

18. In a two-digit number, the sum of the digits is 9 and the square of the tens digit is 3 less than twice the units digit. Find the number.

A. 18

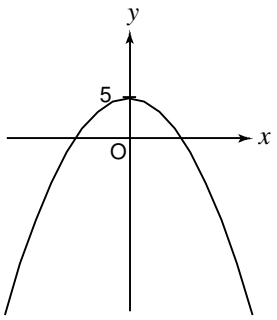
B. 27

C. 36

D. 45

E. 90

19. The figure shows the graph of a quadratic function. Which of the following may be the equation of the graph?



A. $y = x^2 + 5x + 1$

B. $y = 3x^2 - 5x + 1$

C. $y = x^2 + 6x + 5$

D. $y = -2x^2 + x + 5$

E. $y = -5x^2 + x - 5$

20. The area and the perimeter of a rectangle are 126 cm^2 and 46 cm respectively. Calculate the difference between the length and the width of the rectangle.

A. 4 cm

B. 5 cm

C. 6 cm

D. 21 cm

E. 25 cm

21. If $4x^2 - 9y^2 + 5 = 0$ and $2x - 3y = -10$, find the value of $-x - \frac{3y}{2}$.

A. –5

B. –2

C. $-\frac{1}{2}$

D. $-\frac{1}{4}$

E. 4

22. Given the line L: $y = -bx - c$ and the parabola P: $y = ax^2$. If $b^2 - 4ac = 0$, then

I. L touches P.

II. only one (x, y) satisfies both the equations of L and P.

III. there are no solutions for $\begin{cases} y = -bx - c \\ y = ax^2 \end{cases}$.

A. I only

B. II only

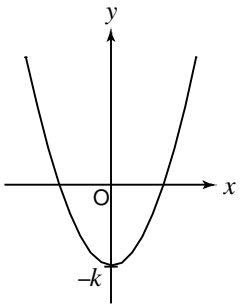
C. III only

D. I and II only

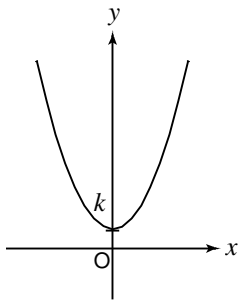
E. II and III only

23. Which of the following shows the graph of the quadratic function $y = 2x^2 + k$, where $k > 0$?

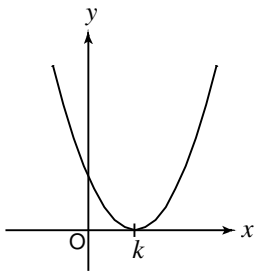
A.



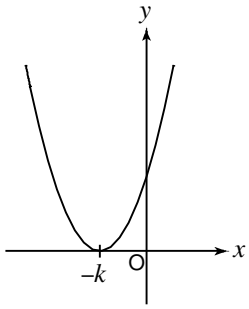
B.



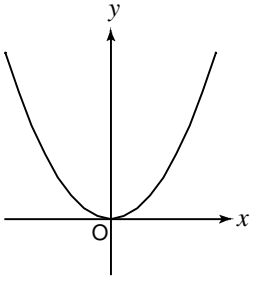
C.



D.



E.



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

A. 1.

B. $\dfrac{x}{x+1}$.

C. $\left(\dfrac{x}{x+1}\right)^2$.

D. $\dfrac{x}{2x+1}$.

E. $\dfrac{x+1}{x+2}$.

25. If $\alpha + \beta = 10$ and $\log \alpha + \log \beta = -1$, find the quadratic equation in x whose roots are α and β.

A. $10x^2 - 100x + 1 = 0$

B. $10x^2 + 100x + 1 = 0$

C. $x^2 - x + 1 = 0$

D. $x^2 + x + 2 = 0$

E. $x^2 - 10x - 100 = 0$

26. Find the remainder when $x^3 + x - 1$ is divided by $2x - 1$.

B. -3

C. $-\dfrac{13}{8}$

D. $-\dfrac{3}{8}$

E. $\dfrac{1}{2}$

27. If a polynomial $f(x)$ is divisible by $x + 1$, then $f(x + 1)$ is divisible by

B. $x - 1$.

C. $x + 1$.

D. x.

E. $x + 2$.

28. $P(x)$ is a polynomial. When $P(x)$ is divided by $3x - 4$, the remainder is R. If $P(x)$ is divided by $4 - 3x$, then the remainder is

A. R.

B. $-R$.

C. $\frac{4}{3}R$.

D. $\frac{4}{3}$.

29. When the expression $x^2 + bx + c$ is divided by $x - 2$, the remainder is -3. Find the value of $6b + 3c + 4$.

A. -25

B. -17

C. -1

D. 7

End of Paper