TEST CODE 01254010/SPEC

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

ADDITIONAL MATHEMATICS

SPECIMEN PAPER

Paper 01 – General Proficiency

90 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of **45** items. You will have 90 minutes to answer them.

2. In addition to this test booklet, you should have an answer sheet.

3. Each item in this test has four suggested answers, lettered (A), (B), (C) and (D). Read each item you are about to answer and decide which choice is best.

4. On your answer sheet, find the number which corresponds to your item and shade the space having the same letter as the answer you have chosen. Look at the sample item below.

   Sample Item

   Evaluate $(4^{-2})^2 \div (1/16)^2$

   (A) 4^{-2}
   (B) 4^{-1}
   (C) 4^{0}
   (D) 4^{2}

   Sample Answer

   A B ● D

   The best answer to this item is " ", so answer space (C) has been shaded.

5. If you want to change your answer, erase it completely before you fill in your new choice.

6. When you are told to begin, turn the page and work as quickly and as carefully as you can. If you cannot answer an item, omit it and go on to the one. You can return later to the item omitted. You score will be the number of correct answers produced.

7. You may do any rough work in the booklet.

8. You may use a silent non-programmable calculator to answer questions.

1. Given that $f(x) = x^3 + 2x^2 - 5x + k$, and that $x - 2$ is a factor of $f(x)$ then k is equal to

(A) -6
(B) -2
(C) 2
(D) 6

2. $a(b+c) - b(a+c)$ is equal to

(A) $a(c-b)$
(B) $a(b-c)$
(C) $c(a-b)$
(D) $c(b-a)$

3. The value of $\sum_{r=1}^{20}(3r-1)$ is

(A) 590
(B) 610
(C) 650
(D) 1220

4. A teacher illustrates AP's by cutting a length of string into 10 pieces so that the lengths of the pieces are in arithmetic progression and the entire length of the string is used up exactly. If the first piece measures 30 cm and the fourth piece measures 24 cm, the total length of the string is

(A) 60 cm
(B) 210 cm
(C) 240 cm
(D) 390 cm

5. The first term of a GP is 16 and the fifth term is 81. Given that the common ratio is positive, the value of the 4th term is

(A) $\frac{81}{16}$

(B) 24

(C) 54

(D) 64

6. The first four terms of a convergent GP is given by 81, 27, 9, 3. The sum to infinity of this GP is

(A) 54
(B) 120.5
(C) 121.5
(D) 243

7. Given that $2 \times 4^{x+1} = 16^{2x}$, the value of x is

(A) -1

(B) $\frac{1}{4}$

(C) $\frac{1}{3}$

(D) $\frac{1}{2}$

8. $\sqrt[n]{2 \times 4^m}$ is equal to

(A) $\sqrt[n]{8^m}$

(B) 2^{n+2m}

(C) 2^{n+mn}

(D) $2^{\frac{2m+1}{n}}$

9. Given that $\log_2 x + \log_2(6x+1) = 1$, the value of x is

(A) $-\frac{2}{3}$

(B)

(C) $\frac{2}{3}$

(D) $\frac{3}{2}$

10. The value of

$\log_4(8) - \log_4(2) + \log_4\left(\frac{1}{16}\right)$ is

(A) -1

(B) $\frac{1}{2}$

(C) 3

(D) 4

11. The expression $\frac{1+\sqrt{3}}{\sqrt{3}-1}$ when simplified is equal to

(A) -1

(B) 1

(C) $\frac{\sqrt{3}+2}{2}$

(D) $\sqrt{3}+2$

12. $f(x) = -5 - 8x - 2x^2$. By completing the square $f(x)$ can be expressed as

(A) $2(x+2)^2 - 4$

(B) $4 - 2(x-2)^2$

(C) $3 - 2(x+2)^2$

(D) $3 - 2(x-2)^2$

13. The roots of the equation $2x^2 - x + 1 = 0$ are

(A) real and equal
(B) real and distinct
(C) not real and equal
(D) not real and distinct

14. For $-2 \le x \le 2$, the maximum value of $4 - (x+1)^2$, and the value of x for which $4 - (x+1)^2$ is maximum are respectively

(A) 5 and 1
(B) 2 and -1
(C) 4 and -1
(D) 4 and 1

15. $f(x) = x(x+5) + 6$. Given that $f(x)$ is one-to-one for $x \ge k$, the value of k is

(A) $-\frac{5}{2}$

(B) $-\frac{2}{5}$

(C) $\frac{2}{5}$

(D) $\frac{5}{2}$

16. If a function f is defined by $f : x \to \frac{x+3}{x-1}$, $x \ne 1$, then $f^{-1}(-4)$ is equal to

(A) -1

(B) $\frac{1}{5}$

(C) 1

(D) 5

17. A function g is defined by $g : x \to 3x - 1$. Expressed in terms of a, g $(3a - 1)$ is

(A) $9a - 1$
(B) $3a - 4$
(C) $9a - 2$
(D) $9a - 4$

18. Functions f and g are defined by
$f: x \to 3x - 2$ and
$g: x \to \frac{12}{x} - 4,\ x \neq 0.$

The composite function fg is defined by

(A) $fg: x \to \frac{36}{x} - 4,\ x \neq 0$

(B) $fg: x \to \frac{12}{x} - 12,\ x \neq 0$

(C) $fg: x \to \frac{12}{x} - 6,\ x \neq 0$

(D) $fg: x \to \frac{36}{x} - 14,\ x \neq 0$

19. The range of values for which $2x^2 < 5x + 3$ is

(A) $-\frac{1}{2} < x < 3$

(B) $\frac{1}{2} < x < 3$

(C) $x < -\frac{1}{2}$ and $x < 3$

(D) $x > -\frac{1}{2}$ and $x > 3$

20. The values of x which satisfy the inequality $\frac{2x-3}{x+1} > 0$ are

(A) $x > -1$ and $x > \frac{3}{2}$

(B) $x > \frac{3}{2}$

(C) $x < -1$ or $x > \frac{3}{2}$

(D) $x > -1$

21. The coordinates of the points A and B are (2, -3) and (-10, -5) respectively. The perpendicular bisector to the line AB is given by the equation

(A) $x - 6y + 20 = 0$

(B) $6x + y + 28 = 0$

(C) $x + 6y - 20 = 0$

(D) $6x + y - 28 = 0$

22. The lines $2y - 3x - 13 = 0$ and $y + x + 1 = 0$ intersect at the point P, where the coordinates of P are

(A) (3, 2)
(B) (3, -2)
(C) (-3, -2)
(D) (-3, 2)

23. The radius, r, and the coordinates of the centre, C, of the circle with equation $x^2 + y^2 - 6x + 4y - 12 = 0$ are

(A) $r = 5$, C (-2, 3),

(B) $r = 25$, C (2, -3),

(C) $r = 12$, C (-3, 2),

(D) $r = 5$, C (3, -2),

24. If the length of the vector $\mathbf{p} = 2\mathbf{i} - k\mathbf{j}$ is $\sqrt{13}$ and k is real, then

I. $k = 3$
II. $k = -3$
III. $k = \sqrt{17}$
IV. $k = -\sqrt{17}$

(A) I or II only
(B) I or III only
(C) I or IV only
(D) II or IV only

25. The value of the real number t for which the two vectors $\mathbf{a} = 4\mathbf{i} + t\mathbf{j}$ and $\mathbf{b} = 2\mathbf{i} - 3\mathbf{j}$ are parallel is

(A) -6

(B) $-\frac{3}{4}$

(C) $\frac{4}{3}$

(D) 6

26. The position vectors of A and B relative to an origin O are $\begin{pmatrix}2\\3\end{pmatrix}$ and $\begin{pmatrix}7\\4\end{pmatrix}$ respectively. The acute angle AOB is given by

(A) $\cos^{-1}\left(\frac{2}{\sqrt{65}}\right)$

(B) $\cos^{-1}\left(\frac{\sqrt{26}}{13 \times 65}\right)$

(C) $\cos^{-1}\left(\frac{\sqrt{2}}{\sqrt{65}}\right)$

(D) $\cos^{-1}\left(\frac{26}{\sqrt{13}\sqrt{65}}\right)$

27. The trigonometrical expression $\frac{1+\sin x}{\cos x} + \frac{\cos x}{1+\sin x}$ is identical to

(A) 1

(B) $\frac{2}{\cos x}$

(C) $\frac{1+\sin x+\cos x}{\cos x(1+\sin x)}$

(D) $\frac{2}{\cos x(1+\sin x)}$

28. $\cos(A - B) - \cos(A + B) \equiv$

(A) $2 \sin A \sin B$
(B) $-2 \sin A \cos B$
(C) $2 \cos A \sin B$
(D) $2 \cos A \cos B$

29. If $\sin\theta = \frac{15}{17}$ and θ is obtuse, then $\cos\theta$ is equal to

(A) $-\frac{8}{15}$

(B) $-\frac{8}{17}$

B. $\frac{8}{15}$

(D) $\frac{8}{17}$

30. The smallest positive angle for which the equation $\sin\theta + \cos\theta = 0$ is

(A) $\frac{\pi}{4}$

(B) $\frac{3\pi}{4}$

(C) $\frac{5\pi}{4}$

(D) $\frac{7\pi}{4}$

31. For $0 \le \theta \le 2\pi$, solutions for the equation $4\sin^2\theta - 1 = 0$ exist in quadrants

(A) 1, 2 and 3
(B) 1, 3 and 4
(C) 2, 3 and 4
(D) 1, 2, 3 and 4

32. $2\sin\left(x-\frac{\pi}{2}\right)$ is equal to

(A) $2\sin x - 2$

(B) $-2\cos x$

(C) $2\cos\left(x+\frac{\pi}{2}\right)$

(D) $2\sin x - \pi$

33. For which of the following ranges of values is $f(x) = 2 + \cos 3x$ valid?

(A) $1 \le f(x) \le 3$
(B) $-1 \le f(x) \le 1$
(C) $-2 \le f(x) \le 2$
(D) $0 \le f(x) \le 2$

34. For $0 \le x \le 2\pi$, the values of x which satisfy the equation $2\cos^2 x + 3\sin x = 0$ are

(A) $x = \frac{\pi}{6}, x = \frac{5\pi}{6}$

(B) $x = -\frac{\pi}{6}, x = -\frac{5\pi}{6}$

(C) $x = \frac{7\pi}{6}, x = \frac{11\pi}{6}$

(D) $x = \frac{5\pi}{6}, x = \frac{7\pi}{6}$

35. Given that $y = (3x-2)^3$, then $\frac{dy}{dx} =$

(A) $3(3x-2)^2$

(B) $3(3x)^2$

(C) $3(3x-2)^3$

(D) $9(3x-2)^2$

36. Given that $y = \frac{3x+5}{2x-11}$, then $\frac{dy}{dx} =$

(A) $\frac{(3x+5)(2)+(2x-11)(3)}{(2x-11)^2}$

(B) $\frac{(2x-11)(3)+(3x+5)(2)}{(2x-11)^2}$

(C) $\frac{(2x-11)(3)-(3x+5)(2)}{(2x-11)^2}$

(D) $\frac{(3x+5)(2)-(2x-11)(3)}{(2x-11)^2}$

37. The curve C is given by the equation $y = 3\sin x + 2$. The value of $\frac{dy}{dx}$ at the point where $x = \frac{\pi}{3}$ is

(A) $\frac{1}{2}$

(B) $\frac{3}{2}$

(C) $\frac{7}{2}$

(C) 3

38. The point $P(2, 2)$ lies on the curve with equation $y = x(x-3)^2$. The equation of the normal to the curve at the point P is given by

(A) $y - 2 = 3(x-2)$

(B) $y - 2 = -3(x-2)$

(C) $y - 2 = \frac{1}{3}(x-2)$

(D) $y - 2 = \frac{-1}{3}(x-2)$

39. The curve C is given by the equation $y = 4x + \frac{9}{x}$. The second derivative, $\frac{d^2y}{dx^2}$, is given by

(A) $4 + \frac{9}{x^3}$

(B) $\frac{18}{x^3}$

C. $4 - \frac{9}{x^3}$

(D) $-\frac{9}{2x^3}$

40. The positive value of z for which $\int_0^z x^2 \, dx = 9$ is

(A) 3
(B) 4.5
(C) 9
(D) 27

41. The gradient of the tangent to a curve C at (x, y) is given by $\frac{dy}{dx} = \frac{1}{(3x+4)^2}$. The curve passes through the point $P\left(-1, \frac{2}{3}\right)$. The equation of the curve C is given by

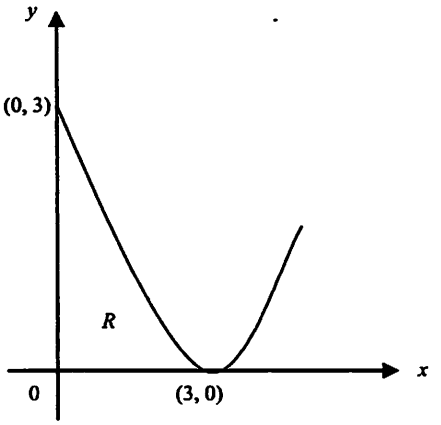
(A) $y = \frac{2}{(3x+4)} + 1$

(B) $y = \frac{-6}{(3x+4)^3}$

(C) $y = \frac{-2}{3(3x+4)} + 4$

(D) $y = \frac{-1}{3(3x+4)} + 1$

Item 42 refers to the figure below.



42. The finite region R is bounded by the y-axis, the x-axis, and the arc of the curve $y = (x-3)^2$ as shown in the figure above. The area of R in square units is

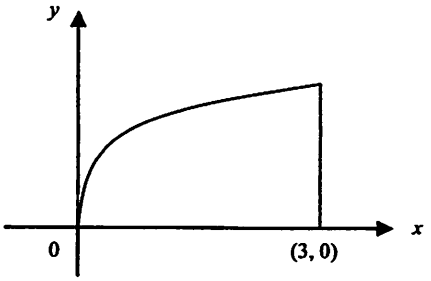
(A) 1

(B) 3

(C) 9

(D) 27

Item 43 refers to the figure below.



43. The finite region enclosed by the curve $y = \sqrt{x}$, $x \geq 0$, the x-axis and the line $x = 3$, as shown in the figure above, is rotated completely about the x-axis. The volume of the solid of revolution formed is given by

(A) $\int_0^3 \sqrt{x}\, dx$

(B) $\pi \int_0^3 x\, dx$

(C) $\pi \int_0^3 \sqrt{x}\, dx$

(D) $\pi \int_0^3 x^2\, dx$

44. $\int (2x + 3)^5\, dx =$

(A) $\left[\frac{1}{6}(2x + 3)^6\right] + C$

(B) $\left[\frac{1}{2}(2x + 3)^6\right] + C$

(C) $\left[\frac{1}{12}(2x + 3)^6\right] + C$

(D) $\left[\frac{1}{3}(2x + 3)^6\right] + C$

45. Given $\frac{dy}{dx} = 3 \sin x - 2 \cos x$, the indefinite integral is given by

(A) $y = 3 \cos x - 2 \sin x + C$

(B) $y = -3 \cos x + 2 \sin x + C$

(C) $y = -3 \cos x - 2 \sin x + C$

(D) $y = 3 \cos x + 2 \sin x + C$

END OF TEST

CSEC ADDITIONAL MATHEMATICS SPECIMEN PAPER 01

Item	Key	Specific Objective
1	A	1A4
2	C	1A1
3	B	1F4
4	B	1F9
5	C	1F7
6	C	1F11
7	D	1E3
8	D	1E2
9	B	1E6
10	A	1E5
11	D	1E1
12	C	1B1
13	D	1B4
14	C	1B2
15	A	1D3
16	B	1D4
17	D	1D7
18	D	1D7
19	A	1C1
20	C	1C2
21	B	2A2
22	D	2A3
23	D	2A5
24	A	2B7
25	A	2B10
26	D	2B9
27	B	2C10
28	A	2C10
29	B	2C4
30	B	2C11
31	D	2C11
32	B	2C8
33	A	2C6
34	C	2C11
35	D	3A8
36	C	3A8
37	B	3A5
38	C	3A17
39	B	3A14
40	A	3B8
41	D	3B9
42	C	3B10(i)
43	B	3B10(ii)
44	C	3B5
45	C	3B7