2020 – 2021
MOCK EXAM
S.6 MATH

PAPER 2

Good Hope School
Mock Examination 2020 – 2021

S.6 Mathematics Compulsory Part
Paper 2
1 hour and 15 minutes

Name	
Class	
Class Number	

INSTRUCTIONS

(1) Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should first write the information required in the spaces provided in both the Question Paper and the Answer Sheet. No extra time will be given for filling in 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. $(-7)^{333} \times 49^{-165} =$

A. -343.
B. -1.
C. 0.
D. 343.

2. If $a(a-b)=3(b+a)$, then $b=$

A. $\frac{a^2+2a}{3+a}$.
B. $\frac{a^2-3a}{3+a}$.
C. $\frac{a^2+3a}{3-a}$.
D. $\frac{a^2-2a}{3-a}$.

3. If $5\alpha + 2\beta + 6 = 2\alpha - \beta = 11$, then $\beta =$

A. -5.
B. -3.
C. 3.
D. 5.

4. $\frac{5}{3x+2} - \frac{4}{3x-2} =$

A. $\frac{1}{9x^2-4}$.
B. $\frac{3x-18}{9x^2-4}$.
C. $\frac{3x+18}{4-9x^2}$.
D. $\frac{1}{4-9x^2}$.

5. Let $f(x) = x^2 + x - 4$. If α is a constant, then $f(-\alpha) - f(\alpha) =$

A. -8.
B. -2α.
C. 2α.
D. 8.

6. If $\alpha > \beta$ and $\alpha^2 + 3\alpha = \beta^2 + 3\beta = 10$ then $\frac{\beta}{\alpha} =$

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

7. If m and n are constants such that $m(x-3)^2 - 2x \equiv 9x^2 + nx(x+2) + 18$, then $n =$

A. -7.
B. -1.
C. 1.
D. 7.

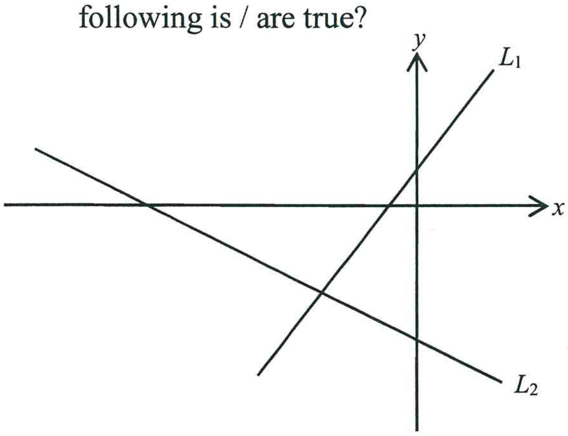
8. If $0.066255 < x < 0.066263$, which of the following is true?

A. $x = 0.0662$ (correct to 3 decimal places)
B. $x = 0.0662$ (correct to 3 significant figures)
C. $x = 0.06626$ (correct to 4 decimal places)
D. $x = 0.06626$ (correct to 4 significant figures)

9. A sum of $30 000 is deposited at an interest rate of 1% per annum for 4 years, compounded monthly. Find the interest correct to the nearest dollar.

A. $1 200
B. $1 218
C. $1 224
D. $31 224

10. 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 is / are true?



I. $ac < 0$
II. $d < bc$
III. $2b > ad$

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

11. Let a and b be non-zero numbers. If $(5a - 2b):(2a + 7b) = 7:8$, then $a : b =$

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

12. If y varies directly as the square of x and inversely as the square root of z, which of the following must be a constant?

A. $\frac{zy^2}{x^2}$
B. $\frac{zy}{x^2}$
C. $\frac{x^4}{zy}$
D. $\frac{x^4}{zy^2}$

13. Let $g(x) = -2x^3 + 3ax^2 - 6x + a^2$, where a is a positive constant. If $g(x)$ is divisible by $x - 2$, find the remainder when $g(x)$ is divided by $x + a$.

A. 56
B. 24
C. 8
D. 0

14. Let a_n be the n^{th} term of a sequence. If $a_5 = 27$, $a_7 = 71$ and $a_{n+2} = a_{n+1} + a_n$ for any positive integer n, then $a_9 =$

A. 44.
B. 98.
C. 115.
D. 186.

15. The solution of $-3(x-1) > 26$ or $\frac{x+1}{2} < -3$ is

A. $x < -\frac{23}{3}$.
B. $x > -\frac{23}{3}$.
C. $x < -7$.
D. $-\frac{23}{3} < x < -7$.

16. The height of a triangle is increased by 50% and its base is decreased by k%. If the area of the triangle remains unchanged, find the value of k.

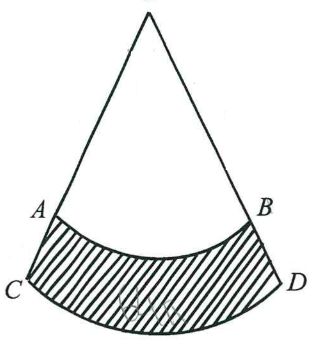
A. $-33\frac{1}{3}$

B. 25

C. $33\frac{1}{3}$

D. 50

17. In the figure, OAB and OCD are sectors with centre O. If $OA = 12$ cm, $OC = 20$ cm and the area of the shaded region $ABDC$ is 64π cm^2, then area of sector $OAB =$

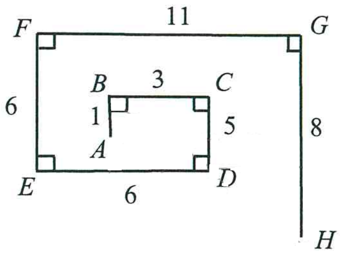


A. 12π cm^2.
B. 24π cm^2.
C. 36π cm^2.
D. 48π cm^2.

18. The side of the base of a solid right square pyramid is 6 cm. If the slant edge of the pyramid is 31 cm, find the total surface area of the pyramid correct to the nearest cm^2.

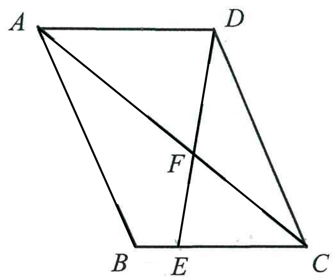
A. 82 cm^2
B. 185 cm^2
C. 221 cm^2
D. 406 cm^2

19. In the figure, the length of the line segment joining A and H is



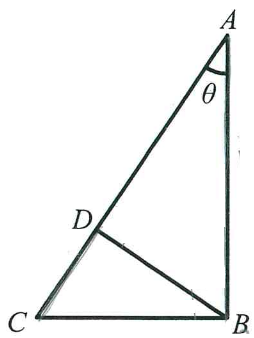
A. 6.
B. 8.
C. 10.
D. 12.

20. In the figure, $ABCD$ is a parallelogram. E is a point lying on BC such that $BE : EC = 2 : 5$. AC and DE intersect at the point F. If the area of ΔCDF is 70 cm^2, then the area of the quadrilateral $ABEF$ is



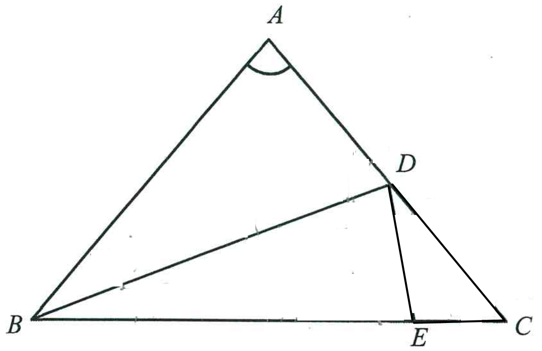
A. 118 cm^2.
B. 163 cm^2.
C. 168 cm^2.
D. 216 cm^2.

21. In the figure, ΔABC is a right-angled triangle with $\angle ABC = 90°$. D is a point on AC such that $BD \perp AC$. If $\angle CAB = \theta$, find $AB : CD$.



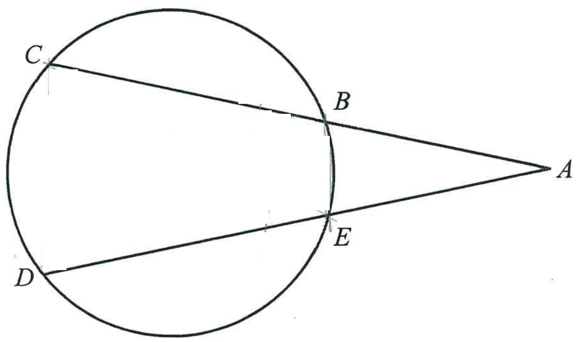
A. $\cos\theta : \sin\theta$
B. $\sin\theta : \tan\theta$
C. $\cos\theta : \sin^2\theta$
D. $\sin\theta : \tan^2\theta$

22. In the figure, $AB = AC$, D and E are points on AC and BC respectively such that $BE = BD$. It is given that $\angle ADB = 80°$ and $\angle DBE = 32°$. $\angle BAC =$



A. 86°.
B. 84°.
C. 74°.
D. 72°.

23. In the figure, AC and AD cut the circle at B and E respectively. If $AC = AD$, which of the following must be true?



I. $BC = ED$
II. $BE \,//\, CD$
III. $BD = EC$

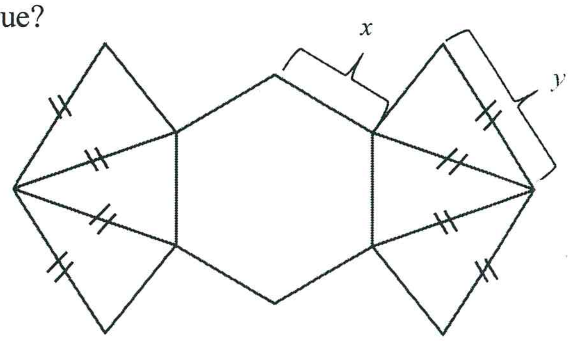
A. I and II only
B. I and III only
C. II and III only
D. I, II and III

24. If $a > b > 0°$ and $a + b = 90°$, which of the following must be true?

I. $\sin a = \sin(180° - b)$
II. $\cos a > \cos(270° - b)$
III. $\tan a > \tan b$

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

25. The figure below consists of a regular hexagon and 6 identical isosceles triangles, where $x < y$. Which of the following is / are true?



I. This is the net of a hexagonal pyramid.
II. The number of axes of reflectional symmetry of the figure is 6.
III. The number of folds of rotational symmetry of the figure is 2.

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

26. The coordinates of the points A and B are (20, 21) and (2, 22) respectively. If P is a moving point in the rectangular coordinate plane such that $AP \perp BP$, then the locus of P is

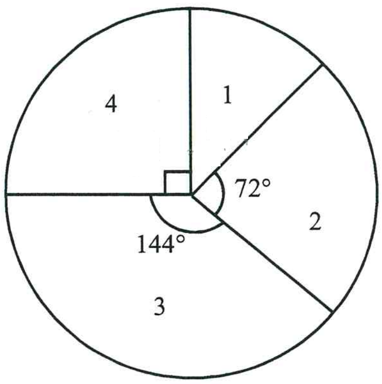
A. the perpendicular bisector of AB.
B. the circle with AB as a diameter, excluding A and B.
C. a pair of straight lines which is equidistant from line AB.
D. a parabola.

27. The equations of the circles C_1 and C_2 are $x^2+y^2+8x-8y+7=0$ and $2x^2+2y^2+8x-4y+7=0$ respectively. Let G_1 and G_2 be the centres of C_1 and C_2 respectively. The coordinates of point E are $(-6, 7)$. Which of the following is / are true?

I. C_1 and C_2 touch each other internally.
II. G_1, G_2 and E are collinear.
III. E lies outside C_1 and C_2.

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

28. The pie chart below shows the distribution of the numbers of books read by a group of students in a week. Find the mean of the distribution.



Distribution of the numbers of books read by a group of students in a week

A. 2.55
B. 2.7
C. 2.75
D. 5.5

29. Two fair dice are thrown in a game. If the product of the two numbers thrown is a prime number, \$100 will be gained; otherwise, \$10 will be gained. Find the expected gain of the game.

A. \$ 17.5
B. \$ 25
C. \$ 27.5
D. \$ 37.5

30. Consider the following positive integers:

3 8 8 10 13 16 18 m n

Let a, b and c be the median, mode and range of the above positive integers respectively. If the mean of the above positive integers is 9, which of the following must be true?

I. $a = 8$
II. $b = 8$
III. $c \geq 16$

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

Section B

31. $4^{17} + 2^{42} + 8^5 =$

A. 4040008000_{16}.
B. 4040000800_{16}.
C. 40400000800_{16}.
D. 40400008000_{16}.

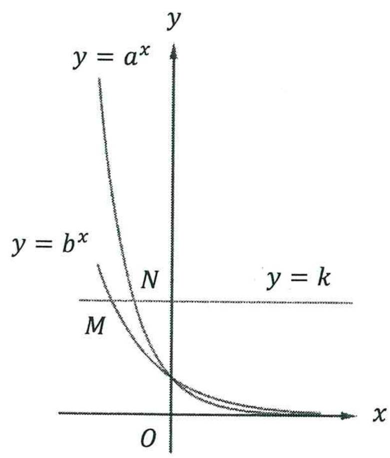
32. It is given that $z = 3 + ki$, where k is a real constant. If $y = z^2 + 4z$ is a purely imaginary number, find y.

A. $\sqrt{21}i$
B. $\pm\sqrt{21}i$
C. $10\sqrt{21}i$
D. $\pm 10\sqrt{21}i$

33. It is given that $\log_8 y$ is a linear function of $\log_2 x$. The intercepts on the horizontal axis and the vertical axis of the graph of the linear function are -2 and 4 respectively. Which of the following must be true?

A. $y = 4096x^6$
B. $y = 16x^2$
C. $y^2 = 256x^4$
D. $y^2 = 2^{\frac{16}{3}}x^{\frac{8}{3}}$

34. The graphs of $y = a^x$ and $y = b^x$ are shown in the figure, where they intersect with the graph of $y = k$ at N and M respectively. Which of the following is/are correct?



I. $0 < a < 1$

II. $MN = \dfrac{\log k \log \frac{b}{a}}{\log a \log b}$

III. $b > a$

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:

$$\begin{cases} x - 12 \le 0 \\ x - y - 15 \le 0 \\ 3x + 5y - 51 \le 0 \\ 4x + y \ge 0 \end{cases}$$

Let S be the region which represents the solutions of the above system of inequalities. If (x, y) is a point lying in S, then the greatest value of $5y + 2x + 123$ is

A. 207.
B. 177.
C. 162.
D. 132.

36. If a and b are positive, which of the following are arithmetic sequences?

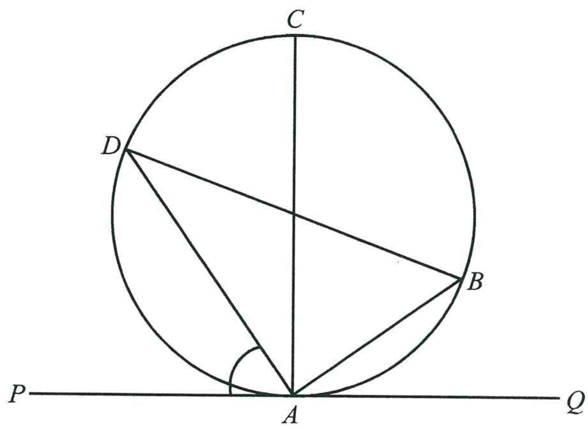
I. $\log(ab^2)$, $\log(ab^3)$, $\log(ab^4)$

II. $\cos^2 a$, $2\cos^2 a + \sin^2 a$, $3\cos^2 a + 2\sin^2 a$

III. a^2b^5, $b^2(a^2b^3 - 1)$, $b^2(a^2b^3 - 2)$

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

37. In the figure, PQ is the tangent to the circle at A and AC is a diameter of the circle. B and D are points on the circle such that $\overset{\frown}{AB} : \overset{\frown}{BC} : \overset{\frown}{CD} = 1 : 3 : 1$. Find $\angle DAP$.



A. 22.5°
B. 45°
C. 60°
D. 67.5°

38. Let k be a constant. The straight line $x - y = 1$ and the circle $x^2 + y^2 - 6x + ky - 27 = 0$ intersect at the points P and Q. If the y-coordinate of the mid-point of PQ is 0, find k.

A. −4
B. 4
C. 6
D. 32

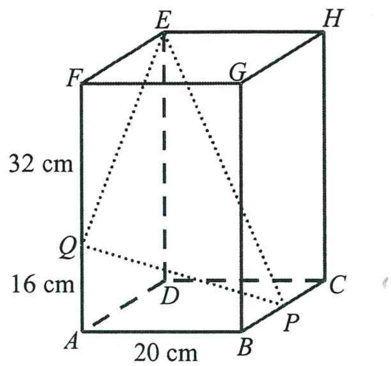
39. It is given that k is a positive constant. The straight line $3x + y = k$ cuts the x-axis and the y-axis at the point P and Q respectively. Let R be a point lying on the x-axis such that the coordinates of the circumcentre of ΔPQR are (7, 5). Find the x-coordinate of R.

A. 8
B. 10
C. 12
D. 14

40. For $0° \leq x < 360°$, how many roots does the equation $3\sin^2 x = 1 - \cos x$ have?

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

41. In the figure, $ABCDEFGH$ is a rectangular block with a square base of side length 20 cm. P is the mid-point of BC. Let Q be a point lying on AF such that $AQ = 16$ cm and $QF = 32$ cm. Find the angle between the plane PQE and the plane $ADEF$ correct to the nearest degree.



A. 49°
B. 50°
C. 59°
D. 60°

42. How many ways are there to arrange letters of the word 'HEXAGON' so that all the vowels are separated?

A. 144
B. 240
C. 1 440
D. 176 400

43. Susan and John are playing a game and they take turns to draw a card from eight cards numbered 1, 2, 3, 4, 5, 6, 7 and 8 with replacement. The first one who draws the card numbered 8 wins the game. Susan draws the cards first. Find the probability that Susan wins.

A. $\frac{8}{9}$
B. $\frac{8}{15}$
C. $\frac{7}{15}$
D. $\frac{1}{8}$

44. In a test, the variance of the test scores is 100. The test score of John is 45 and his standard score is –1.7. If the standard score of Susan in the test is 0.2, then her test score is

A. 26.
B. 30.
C. 64.
D. 235.

45. Let m, r and s be the mean, the range and the standard deviation of a group of numbers $\{x_1, x_2, ..., x_{100}\}$ respectively while M, R and S be the mean, the range and the standard deviation of the group of numbers $\{ax_1 - b, ax_2 - b, ..., ax_{100} - b\}$ where a is a positive constant. Which of the following must be true?

	$\underline{M}$	$\underline{R}$	$\underline{S}$
A.	m	ar	as
B.	m	$r - b$	$s - b$
C.	$am - b$	$am - b$	$as - b$
D.	$am - b$	ar	as

END OF PAPER