ST. STEPHEN'S GIRLS' COLLEGE
Final Examination 2018 – 2019

FORM 4
149 students **LC, LHK, SCHL**

MATHEMATICS
Time allowed: 2 hours
Question/Answer Paper

Please read the following instructions very carefully.

1. Write your class, class number and name in the spaces provided on this cover.

2. This paper consists of TWO sections, A and B. Section A carries 36 marks and Section B carries 64 marks. **Attempt ALL questions in this paper.**

3. For **Section A**, you should put your answers on the **"Multiple Choice Answer Sheet"** provided. Note that you may only mark **ONE** answer for each question. Two or more answers will score **NO MARKS**.

4. For **Section B**, write your answers in the spaces provided in this **Question/Answer Paper.**

5. Graph paper and supplementary answer sheets will be supplied on request. Write your class, class number and name on each sheet, which should be stapled to this paper.

6. Unless otherwise specified, all working must be clearly shown.

7. Unless otherwise specified, numerical answers should either be exact or correct to 3 significant figures.

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

Class	
Class No.	
Name	

	Marker's Use Only	
A		
B	25	
	26	
	27	
	28	
	29	
	30	
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	36	
	37	
	38	
Total		/ 100

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SECTION A (36 marks, all questions carry equal marks): You are advised to spend 40 minutes on this section.

1. $\left(\frac{1}{4}\right)^{333}(-8)^{221} =$

A. $\frac{-1}{8}$.
B. $\frac{-1}{4}$.
C. -4.
D. -8.

2. $\frac{a^{2n}-a^n}{a^n} =$

A. 1.
B. a^{2-n}.
C. a^2-1.
D. a^n-1.

3. Solve the equation $(3x-7)^2=(x+1)(3x-7)$.

A. $x=4$
B. $x=\frac{7}{3}$
C. $x=4$ or $x=\frac{7}{3}$
D. $x=-4$ or $x=\frac{7}{3}$

4. If α is a root of the quadratic equation $3x^2-2x-1=0$, then $7+4\alpha-6\alpha^2=$

A. 5.
B. 7.
C. 12.
D. 17.

5. Let k be a constant. If the quadratic equation $x^2 + kx + k = 1$ has equal roots, then $k =$

A. -1.
B. 2.
C. 0 or -4.
D. 0 or 3.

6. If α and β are constants such that $(x-7)(x+\alpha)-5\equiv(x-5)^2+\beta$, then $\beta=$

A. -51.
B. 10.
C. -9.
D. -1.

7. Solve $x^2-kx-x+3=0$.

A. $x=\frac{k+1\pm\sqrt{(k+1)^2-12}}{2}$
B. $x=\frac{-(k+1)\pm\sqrt{(k+1)^2-12}}{2}$
C. $x=\frac{k\pm\sqrt{k^2-12}}{2}$
D. $x=\frac{-k\pm\sqrt{k^2-12}}{2}$

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8. If k is a real number, then the real part of $2-i(ki-1)$ is

A. $2-k$.
B. $-k$.
C. 2.
D. $2+k$.

9. If $f(x)=2x^2-x+1$, then $f(2k-3)=$

A. $8k^2-14k+16$.
B. $8k^2-14k+22$.
C. $8k^2-26k+16$.
D. $8k^2-26k+22$.

10. Which of the following statements about the graph of $y=(5+x)(6-x)-18$ is/are true?

I. The graph opens downwards.
II. The graph passes through the point (1, 18).
III. The x-intercepts of the graph are −3 and 4.

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

11. Let h be a constant such that $2x^4+hx^3-4x-12$ is divisible by $2x+h$. Find h.

A. 6
B. 2
C. −2
D. −6

12. If h and k are constants such that $hx(x-1)+x^2 \equiv kx(x-2)+4x$, then $h=$

A. 1.
B. 2.
C. 3.
D. 4.

13. Let $f(x)=x^5-2x+a$, where a is a constant. If $f(x)$ is divisible by $x+1$, find the remainder when $f(x)$ is divided by $x-1$.

A. 0
B. −1
C. 2
D. −2

14. Find the L.C.M. of $x-2y$, $x^2-4xy+4y^2$ and x^3-8y^3.

A. $x-2y$
B. $(x-2y)^2(x^2+2xy+4y^2)$
C. $(x-2y)^2(x^2-2xy+4y^2)$
D. $(x-2y)^4(x^2+2xy+4y^2)$

15. For $0° \le \theta \le 360°$, how many distinct roots does the equation $3\cos^2\theta+\cos\theta-4=0$ have?

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

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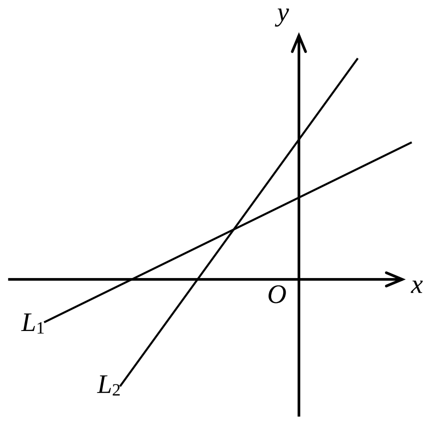
16. The straight line L is perpendicular to the straight line $6x+7y-42=0$. If the x-intercept of L is 6 , then the equation of L is

A. $7x-6y-42=0$.
B. $7x-6y+42=0$.
C. $6x-7y-36=0$.
D. $6x-7y+36=0$.

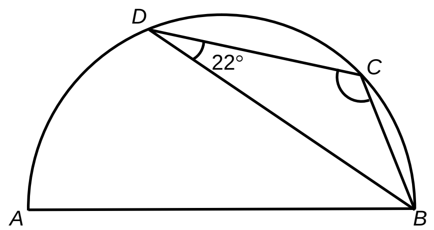
17. In the figure, the equations of the straight lines L_1 and L_2 are $ax+y=b$ and $cx+2y=d$ respectively. Which of the following is/are true?



I. $\frac{c}{a}>2$ II. $\frac{d}{b}>2$ III. $ad<bc$

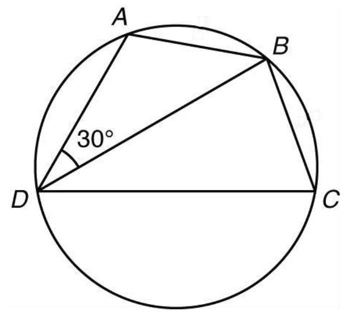
A. I only
B. I and II only
C. II and III only
D. I, II and III

18. In the figure, $ABCD$ is a semicircle. If BD bisects $\angle ABC$ and $\angle BDC = 22°$, then $\angle BCD =$



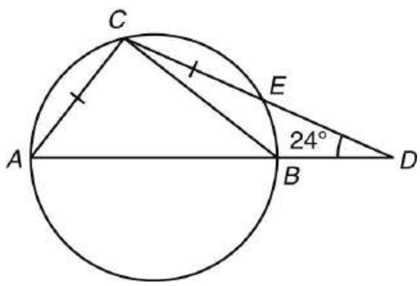
A. 112°.
B. 124°.
C. 130°.
D. 136°.

19. In the figure, $\overset{\frown}{AB}=\overset{\frown}{BC}$ and $\overset{\frown}{CD}=2\overset{\frown}{AD}$. Find $\angle BCD$.



A. 50°
B. 60°
C. 70°
D. 80°

20. In the figure, AB is a diameter of the circle. AB and CE are produced to meet at D. If $AC = CE$, find $\angle ABC$.



A. 14°
B. 24°
C. 38°
D. 52°

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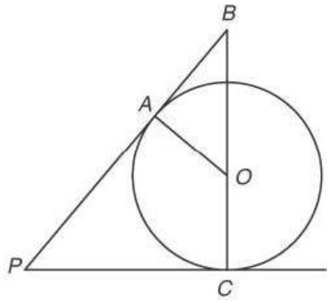
21. In the figure, PB and PC are tangents to the circle at A and C respectively. BC passes through the centre O. Which of the following must be true?

I. $\triangle BAO \sim \triangle BCP$
II. $BC = CP$
III. O, A, P and C are concyclic.

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

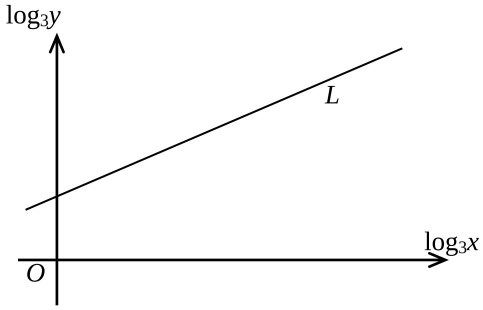


22. If $\log 3x = 2\log x - 1$, then $x =$

A. 2.
B. 3.
C. 30.
D. 0 or 30.

23. In the figure, the straight line L shows the relation between $\log_3 x$ and $\log_3 y$. It is given that L passes through the point (3, 4) and (9, 6). If $y = kx^a$, then $k =$

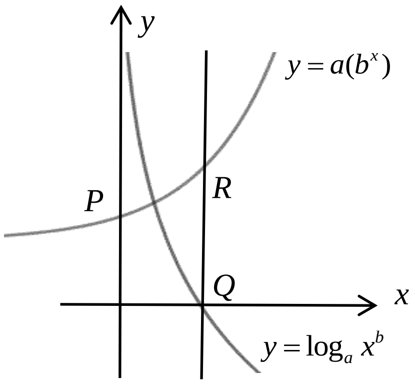
A. $\frac{1}{3}$.
B. 3.
C. 9.
D. 27.



24. The figure shows the graph of $y = a(b^x)$ and the graph of $y = \log_a x^b$ on the same rectangular coordinate system, where a and b are positive constants. The graph of $y = a(b^x)$ cuts the y-axis at P. If a vertical line cuts the graph of $y = \log_a x^b$ at R and it also cuts the graph of $y = \log_a x^b$ and the x-axis at the same point Q, which of the following is/are true?

I. $a > 1$
II. $a < b$
III. $PR = a(b-1) + 1$

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



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SECTION B (64 marks)

25. Make k the subject of the formula $\frac{1}{2h}+\frac{2}{k}=1$. (3 marks)

26. Simplify $\frac{x^{-2}y^{4}}{(\sqrt[4]{x}y^{-3})^{4}}$ and express your answer with positive indices. (3 marks)

27. Factorize
   (a) $9a^2-4$,
   (b) $3a^2b+13ab-10b$,
   (c) $9a^2-4-3a^2b-13ab+10b$. (4 marks)

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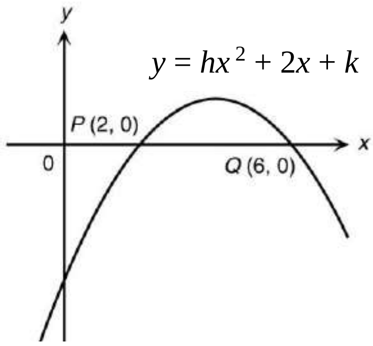
28. Simplify $\dfrac{x+3}{x^2-9}-\dfrac{2x+6}{x^2+6x+9}$. (3 marks)

29. The figure shows the graph of $y = hx^2 + 2x + k$. It cuts the x-axis at two points $P(2, 0)$ and $Q(6, 0)$. Find the values of h and k. (4 marks)



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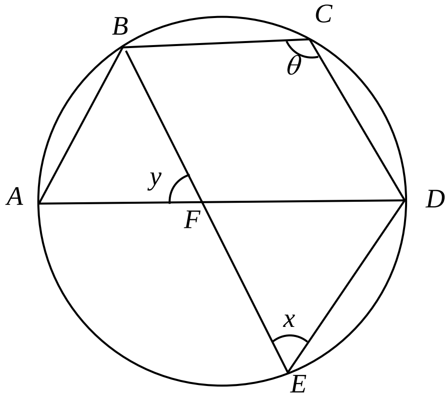
30. In the figure, *ABCDE* is a circle. It is given that *AB* // *ED*. *AD* and *BE* intersect at the point *F*. Express x and y in terms of θ. (5 marks)



31. Simplify $2\cos(270° + \theta)\cos 60° + \sin 90° \sin(180° - \theta)$. (3 marks)

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32. Solve $4\sin^2\theta - 4\cos\theta - 1 = 0$ for $0° \le \theta \le 360°$. (4 marks)

33. (a) Solve $y^2 - 6y + 5 = 0$. (1 mark)

(b) Hence, or otherwise solve $36^x - 6^{x+1} + 5 = 0$. (3 marks)

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34. It is given that a straight line L_1 passes through (2, 4) and has a slope $\frac{1}{2}$. L_1 intersects with another straight line $L_2 : 3x + 4y - 32 = 0$ at point P.

(a) Find the equation of L_1 (2 marks)

(b) Find the coordinates of P. (2 marks)

(c) It is known that L_1 and L_2 cut the y-axis at A and B resepctively. Find the circumcentre of ΔABP. (3 marks)

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35. The polynomial $f(x) = -4x^3 + (a+2)x^2 - bx - 15$ is divisible by $x+1$ and $x-3$.

(a) Find the values of a and b. (4 marks)

(b) Someone claims that all the roots of the equation f (x) = 0 are integers. Do you agree? Explain your answer. (3 marks)

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36. Let $p(x)$ be a cubic polynomial. When $p(x)$ is divided by $(x-1)$, the remainder is 16. When $p(x)$ is divided by $(x+1)$, the remainder is 8. It is given that $p(x)$ is divisible by (x^2-x+2).

(a) Find the linear quotient when $p(x)$ is divided by (x^2-x+2). (3 marks)

(b) How many rational roots does the equation $p(x)=0$ have? Explain your answer. (3 marks)

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37. (a) Let $f(x) = x^2 - 20x + 200$. Using the method of completing the square, find the coordinates of the vertex of the graph of $y = f(x)$. (2 marks)

(b) Susan cuts a string of 20 m long into two pieces. Each piece of the string is bent to form two squares. One piece of the string is x m long. Let A m^2 be the total area of the two squares.

(i) Express A in terms of x.

(ii) Susan claims that the sum of areas of these two squares must be greater than 12 m^2. Do you agree? Explain your answer. (4 marks)

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38. It is given that $\log_{25} y$ is a linear function of $\log_5 x$. The intercepts on the vertical axis and on the horizontal axis of the graph of the linear function are 4 and −3 respectively. Express the relation between x and y in the form $y = Ax^k$, where A and k are constants. (5 marks)

***** END OF PAPER *****

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