Form 3   **WYL, SCHL, CYN, YLN**
155 students

Mathematics
Time allowed: 1 hour 30 minutes
Question/Answer Paper

Please read the following <u>instructions</u> very carefully.

Class	
Class No.	
Name	

1. This paper consists of TWO sections, A and B.

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

3. This paper carries 100 marks.   Attempt ALL questions in this paper.   Write your answers in the spaces provided in this Question/Answer Paper.

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

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

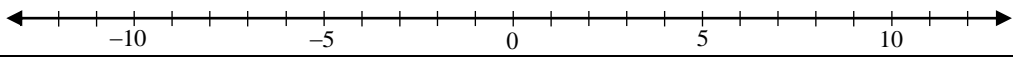| For Markers' Use Only		
1 – 16		(40)
17 – 18	(3)	(4)
19 – 20	(4)	(4)
21 – 22	(4)	(6)
23		(5)
24		(10)
25		(6)
26		(6)
27		(8)
TOTAL		(100)

Section A (40%)

All rough work should be done on the rough work paper provided, but will not be marked.

Questions	Answer	Marks
1. Factorize the following polynomials. (a) $x^2 - 7x - 30$ (b) $-2p^2 + 50q^2$ (c) $2y^3 - 24y^2 + 72y$	1. (a) _____ (b) _____ (c) _____	 1 2 2
2. Determine which of the following statements is/are true. Circle the correct answer. (a) $144y^2 - 120xy + 25x^2 \equiv (5x - 12y)^2$ (b) $-a^2 + 6a - 9 \equiv (3 - a)^2$ (c) $64x^3 - 125 \equiv (4x - 5)(16x^2 + 20x + 25)$	2. (a) True / False (b) True / False (c) True / False	 1 1 1
3. Make b the subject of $y = a - \dfrac{c+b}{b}$.	3. _____	2
4. If $\dfrac{2^{2n} \times 9^n}{3^n} = a^n$, where a is an integer, find a.	4. _____	2
5. Express the following numbers in scientific notation. (a) $-2\,530\,000$ (b) $0.000\,000\,39$	5. (a) _____ (b) _____	1 1
6. Arrange the following numbers in ascending order. I. -2.34×10^{-70} II. 2.34×10^{70} III. -2.34×10^{70} IV. 2.34×10^{-90}	6. ____<____<____<____	2
7. Consider the binary number $101\underline{1}00_{(2)}$. (a) Write down the place value of the underlined digit.	7. (a) _____	1
(b) Express $101100_{(2)}$ in the expanded form. **Answer for (b)** : _____		1
8. Convert the decimal number $8^4 + 8^{11}$ into a hexadecimal number.	8. _____	2
9. If \$32 000 is deposited in a bank at a simple interest rate of 3% p.a., how many years will it take to receive an amount of \$34 880?	9. _____	2

/22

10.	If the length and the width of a rectangle are increased by 10% and decreased by 30% respectively, find the percentage change in the area of the rectangle.	10. _____	2

11.	The table below shows the salaries tax rates:	11.	

Net chargeable income	Tax rate
On the first $40 000	2%
On the next $40 000	7%
On the next $40 000	12%
Remainder	17%

(a) (i) If the net chargeable income is $40 000, find the salaries tax payable.	(a)(i) _____ 1
(ii) If the net chargeable income is $80 000, find the salaries tax payable.	(ii)_____ 1
(b) If David's salaries tax payable is $4 200, find his net chargeable income.	(b) _____ 2

12.	It is given that $x < -\dfrac{1}{2}$ and $y = \dfrac{5}{6} - \dfrac{1}{3}x$. Find the range of the values of *y*.	12. _____	2

13.	(a) Solve the inequality $\dfrac{2x+7}{3} > x+4$.	13. (a) _____	2
	(b) Represent the solution of (a) on the following number line.		1

14.	Determine whether each of the following statements must be true. Circle the correct answer.	14.	
	(a) If $a > b > c$, then $ab > bc$.	(a) True / False	1
	(b) If $x > y > z$, then $x - y > y - z$.	(b) True / False	1
	(c) If $p > q > r > 0$, then $\dfrac{p}{r} > \dfrac{q}{r}$.	(c) True / False	1

15.	It is given a set of data: 15, 3, 10, 15, 22, 11, *m*, *n*. If the mode of the above set of data is 10, find the values of *m* and *n*.	15. *m* = _____ *n* = _____	1 1

16.	Consider the positive integers: $4 , 4 , 5 , 6 , x , y$. If the mean of the above data is 4, which of the following is/are true? I. $x + y = 5$ II. Median $= 4$ III. Mode $= 4$	16. _____	2

/18

Section B　(60%)

All working must be clearly shown in the spaces provided.

17.　Simplify $\left(\dfrac{-x^6 y^{-3}}{x^{-2} y} \right)^3$ and express the answer with positive indices.　　(3 marks)

18.　(a)　Solve the inequality $\dfrac{2x+1}{5} - 1 < x + 2$.　　(3 marks)

　　(b)　Write down all negative integers satisfying the inequality in (a).　　(1 mark)

19. A shop produces cheese cakes and chocolate cakes only. The costs of producing one cheese cake and one chocolate cake are \$65 and \$35 respectively. If 140 cakes are produced on one day and the total cost should not exceed \$8000, at least how many chocolate cakes should be produced?

(4 marks)

20. In a cylinder, its base radius is 5 cm and volume is 150π cm^3. Find the total surface area of the cylinder. Give your answer in terms of π. (4 marks)

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21. The value of a pair of earphones was \$800 in 2015 and its value has decreased at a fixed rate each year. In 2017, the value of the earphones decreased to \$648.

    (a) Find the decay factor of the value of the earphones. (2 marks)

    (b) Suppose the decay factor of the value of the earphones remains unchanged, find the value of the earphones in 2011. Give your answer correct to the nearest dollar. (2 marks)

22. A carbon dioxide molecule consists of one carbon atom and two oxygen atoms. The weights of a carbon atom and an oxygen atom are 1.99×10^{-26} kg and 2.67×10^{-26} kg respectively.
    (Express the answers of (a) and (b)(i) in scientific notation.)

    (a) Find the weight of a carbon dioxide molecule. (2 marks)

    (b) A carbon dioxide extinguisher contains 1.9791 kg of carbon dioxide.
        (i) Find the number of carbon dioxide molecules in the extinguisher.
        (ii) Find the total weight of the oxygen atoms in the extinguisher.

        (4 marks)

23. The table below shows the marks that Mak and Millie got in various subjects in an examination and the weight of each subject.

	Chinese	English	Mathematics	P.E.
Mak	82	y	95	63
Millie	80	90	64	88
Weight	4	4	x	1

It is given that the weighted mean mark of Millie is 80.

(a) Find x. (2 marks)

(b) Given that the weighted mean mark of Mak is higher than that of Millie by 5 marks, find y. (3 marks)

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24. In the figure, *PRT* and *QRS* are straight lines. *PQ = QT* and *PQ // ST*.

    (a) Prove that $\Delta PQR \sim \Delta TSR$. (3 marks)

    (b) Prove that *PT* is the angle bisector of $\angle QTS$. (3 marks)

    (c) If *PQ = ST*, is *QR* a perpendicular bisector of ΔPQT ? Explain your answer. (4 marks)

25. Factorize

    (a) $5a^2 - 8ab - 4b^2$,   (1 mark)

    (b) $25a^2 - 4b^2$,   (1 mark)

    (c) $100a^2x - 5a^2 + 4b^2 - 16b^2x + 8ab$.   (4 marks)

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26. In Figure 1, a piece of wire is bent into a sector of radius 12 cm and the angle of sector is $60°$.

    (a) Find the area enclosed by the wire in Figure 1. (2 marks)

    (b) In Figure 2, the sector is reshaped into a circle. Someone claims that the area of the circle is smaller than the area of the sector. Do you agree? Explain your answer. (4 marks)

Figure 1

Figure 2

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27. John deposits a fixed amount x into an account at the beginning of each month in Bank A at an interest rate of 12% p.a. compounded monthly.

    (a) Find the total amount in the account at the end of the first month in terms of x. (2 marks)

    (b) It is given that the total amount in the account at the end of the third month is $306 040.1.
         (i) Find x. (3 marks)
         (ii) Someone claims that the total amount in the account at the end of the **second** month can be exactly twice that of the amount in the account at the end of the **fourth** month if John deposits $2x$ at the beginning of each month. Is the claim correct? Explain your answer.

(3 marks)

F.3 Mathematics Mid-Year Examination 2020-2021

End of Paper