ST. STEPHEN'S GIRLS' COLLEGE

Mid-Year Examination 2019 – 2020

Form 3 **MWC, WYL, SCHL**

146 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 – 17		(40)
18 – 19	(3)	(5)
20 – 21	(4)	(5)
22 – 23	(8)	(3)
24 – 25	(8)	(10)
26 – 27	(6)	(8)
TOTAL		(100)

Section A (40%)

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

		Answer	**Marks**
1.	Factorize the following polynomials. (a) $98m^2 - 162n^2$ (b) $-8x + 4x^2 + 3$ (c) $3a^3 + 108a - 36a^2$	1. (a) _____ (b) _____ (c) _____	 2 2 2
2.	Make b the subject of $x = \frac{a-b}{2a-b} - c$.	2. _____	2
3.	Evaluate $\left(-\frac{1}{3}\right)^{997} (3^2)^{498}$.	3. _____	2
4.	Express the following numbers in scientific notation. (a) 14 200 000 (b) −0.000 000 043	4. (a) _____ (b) _____	 1 1
5.	Consider the binary number $110\underline{1}01_2$. (a) Write down the place value of the underlined digit. (b) Hence, express 110101_2 in the expanded form.	5. (a) _____ (b) _____	 1 1
6	Convert the decimal number $9\times16^4+12\times2^{12}+27$ into a hexadecimal number.	6. _____	2
7.	The length of each side of a cube is decreased by 10%. Find the percentage change in its volume.	7. _____	2
8.	The temperature of the water in a pot is 60°C now. If the temperature decreases by 5% every 5 minutes, find the temperature of the water in the pot 30 minutes ago, correct to 3 significant figures.	8. _____	2
9.	John pays $3200 per quarter for the rates of his flat. If the rates are charged at 5% p.a., what is the rateable value of his flat?	9. _____	2

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10.	The table below shows the salaries tax rate: If the net chargeable income of David is more than \$120 000 and his salaries tax payable is 11% of his net chargeable income, how much salaries tax should he pay?	10. _____	2
11.	Write down the smallest integer that satisfies the following inequality. $\frac{1-4x}{2} \le 2-x$	11. _____	2
12.	Solve $\frac{4-5x}{2} < x+14$ and represent its solution graphically on a number line.	12. _____ 0	2 1
13.	Determine whether each of the following statements must be true. Circle the correct answer. (a) If $a > b > 0$, then $5 - a < 5 - b$. (b) If $a > 0 > b$, then $a^2 < b^2$. (c) If $p^2 > q^2$ and $p, q \neq 0$, then $\frac{1}{p} < \frac{1}{q}$.	13. (a) True / False (b) True / False (c) True / False	 1 1 1
14.	Drink *A* contains 20% tea and 80% milk by volume. Drink *B* contains 80% tea and 20% milk by volume. Some drink *A* and drink *B* are mixed to produce drink *C* of volume 1000 mL. If drink *C* contains at most 380 mL of tea, find the minimum volume of drink *A* used.	14. _____	2
15.	Find the mean and median of the following set of data.	15. Mean : _____ Median : _____	 1 1

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%

Number	$x-4$	x	$x+4$	$x+8$
Frequency	2	2	2	6

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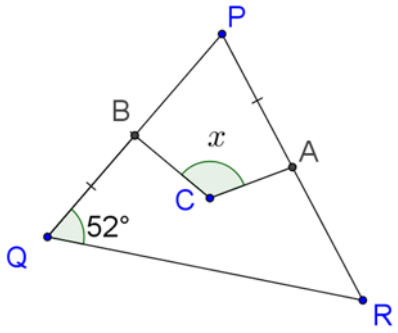
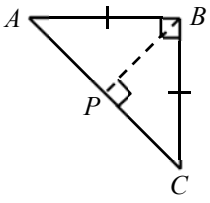
16.	In the figure, C is the circumcentre of ΔPQR . $AP = BQ$ and $\angle PQR = 52°$. If A and B are the mid-points of PR and PQ respectively, find x. 	16. _____	2
17.	In the figure, ΔABC is a right-angled triangle where $AB = BC$. If P is a point lying on AC such that $BP \perp AC$, which of the following is/are true? I. Point B is the orthocentre of ΔABC. II. ΔABP is an equilateral triangle. III. Point P is the circumcentre of ΔABC. 	17. _____	2

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Section B (60%)

All working must be clearly shown in the spaces provided.

18. Simplify $\left(\dfrac{3y}{2x^{-1}y^{2}}\right)^{-3}$ and express the answer with positive indices. (3 marks)

19. A Chinese examination consists of 4 papers I, II, III and IV. The following table shows the marks Michelle and Nancy got in each paper. It is given that the weighted mean mark of Michelle is 53.

	Michelle's marks	Nancy's marks	Weight
Paper I	51	70	x
Paper II	35	22	40
Paper III	79	58	100
Paper IV	31.5	y	x

(a) Find the value of x. (2 marks)

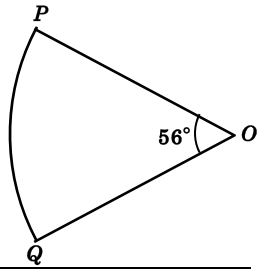
(b) Given that the weighted mean mark of Nancy is lower than that of Michelle, find the greatest value of y if y is an integer. (3 marks)

20. The value of a watch was \$9 000 in 2012 and its value has increased at a fixed rate each year. In 2015, the value of the watch increased to \$15 552.
    (a) Find the growth factor of the value of the watch. (2 marks)
    (b) Suppose the growth factor of the value of the watch remains unchanged, find the value of the watch in 2019. Give your answer correct to the nearest dollar. (2 marks)

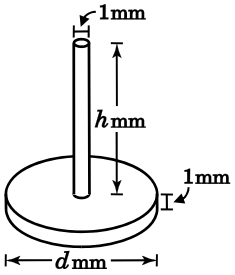
21. Tim bought a flat at $\$7.37 \times 10^6$ in 2016.
    (a) If Tim spent \$780 000 in the renovation work, find the total amount he spent on the flat. (Give your answer in scientific notation) (2 marks)
    (b) If the value of the flat increases by 5% every year, will it be greater than 12 million dollars in 2026? Explain your answer. (3 marks)

22. A snack shop sells two kinds of candy, Candy *A* and Candy *B*. A bag of Candy *A* contains 44 candies while a bag of Candy *B* contains 32 candies. Tom wants to buy 8 bags of candy with not less than 310 candies. It is given that Tom has bought *n* bags of Candy *B*.
    (a) Find the maximum value of *n*. (4 marks)
    (b) The prices of a bag of Candy *A* and a bag of Candy *B* are \$80 and \$70 respectively.
        (i) Express the amount Tom should pay in terms of *n*.
        (ii) Using the result of (a), if Tom has \$600, does he have enough money to buy the candies? Explain your answer. (4 marks)

23. A piece of wire of 48 cm long is bent into a sector *OPQ* as shown in the figure, where the angle of the sector is 56°. Find the radius of the sector, correct to 3 significant figures. (3 marks)



24. In the figure, a solid is composed of two cylinders. The two cylinders have the same curved surface area. The diameter and the height of the top cylinder are 1 mm and h mm respectively and those of the bottom cylinder are d mm and 1 mm respectively.



(a) Express h in terms of d. (2 marks)

(b) It is given that the volume of the top cylinder is 3π mm^3.

(i) Find h.

(ii) Find the total surface area of the solid in terms of π.

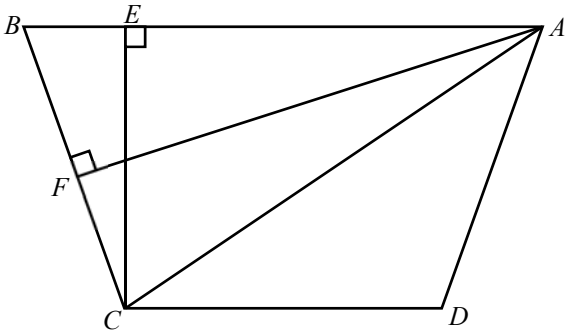
(6 marks)

25. In the figure, $ABCD$ is a trapezium. It is given that CE and AF are altitudes of ΔABC and $AB = AC$.

(a) Prove that $\Delta ABF \cong \Delta ACF$. (3 marks)

(b) Prove that $\Delta AFB \sim \Delta CEB$. (2 marks)

(c) Hence, prove that $CB \times CF = BE \times AC$. (5 marks)



26. (a) Factorize

(i) $2y^2 + 5yz - 3z^2$,

(ii) $4x^2 + 5x - 6$. (2 marks)

(b) Hence or otherwise, factorize $4x^2 + 3z^2 + 2xy + 13xz - 2y^2 - 5yz$. (4 marks)

27. Sam borrowed \$36 000 from Bank *A* at 18% p.a. compounded monthly. He agreed to repay \$12 400 each month. The last repayment may be less than or equal to \$12 400.

(a) How much did Sam owe Bank *A* for the 1st month **after** paying the 1st repayment? (1 mark)

(b) (i) Can he repay the loan after 3 repayments? Explain your answer.

(ii) Find the interest he paid to Bank *A*. Give your answer correct to the nearest dollar. (4 marks)

(c) Bank *B* offers the same loan to Sam at 9 % p.a. compounded monthly. He has to repay \$24 800 to Bank *B* every two months. If he wants to pay less interest, which bank should he choose? Explain your answer. (3 marks)

End of Paper