ST. STEPHEN'S GIRLS' COLLEGE

Mid-Year Examination 2018 – 2019

Form 3 **MWC, WYL, SCHL**

166 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.

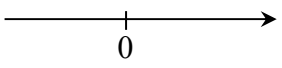
5. Unless otherwise specified, numerical answers should either be exact or correct to 3 significant figures.

For Markers' Use Only		
1 – 16		(40)
17 – 18	(3)	(4)
19 – 20	(4)	(4)
21 – 22	(6)	(3)
23 – 24	(8)	(4)
25 – 26	(6)	(6)
27 – 28	(6)	(6)
TOTAL		(100)

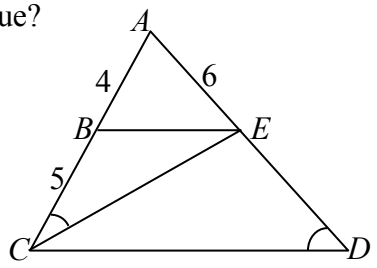
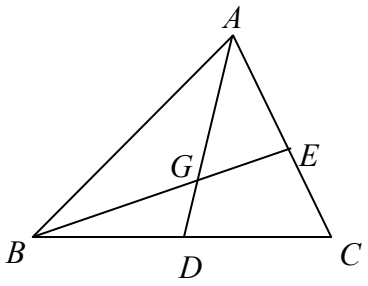
Section A (40%)

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) $64a^2 - 25b^2$ (b) $m^2 - 8m + 12$ (c) $-56xy + 16y^2 + 49x^2$	1. (a) _____ (b) _____ (c) _____	 2 2 2
2.	Express the following numbers in scientific notation. (a) 0.000 000 84 (b) −315 000 000	2. (a) _____ (b) _____	 1 1
3.	It is given that $9^{m-2} = \left(\frac{1}{3}\right)^{n-1}$, express n in terms of m.	3. _____	2
4.	Convert the decimal number $6 \times 2^9 + 2^{39}$ into a hexadecimal number.	4. _____	2
5.	The population of a city increases at a rate of 5% per year. It is known that the population in that city is 550 000 this year. (a) Find the growth factor. (b) Find the population of the city 4 years ago. (Give your answer correct to the nearest integer.)	5. (a) _____ (b) _____	 1 2
6.	The table below shows the salaries tax rate: Net chargeable income / Tax rate On the first \$30 000 / 2% On the next \$30 000 / 7% On the next \$30 000 / 13% Remainder / 19% The annual income of David is \$350 000. If he is eligible for a salaries tax allowance of \$192 000, how much salaries tax should he pay?	6. _____	2
7.	The price of a flat is \$$P$ in 2010. The price of the flat increases at a constant rate of 5% per year from 2010 to 2014 and decreases at a constant rate of 9% per year from 2014 to 2017. Find the percentage change in the price of the flat from 2010 to 2017. (Give your answer correct to 3 significant figures.)	7. _____	3
		Subtotal:	/20

8.	Make n the subject of $4n = 2x - (n-2)y$.	8. _____	2
9.	Solve $5(x-2)+8(7-x)<25$ and represent its solutions graphically on a number line.	9. _____  	2 1
10.	Determine whether each of the following statements must be true. Circle the correct answer. (a) If $x < y$, then $x - 4 > y - 3$. (b) If $a > 0 > b$, then $\frac{1}{2a} < \frac{1}{2b}$. (c) If $p^2 < q^2$ and $q \neq 0$, then $\frac{p}{q} < 1$.	10. (a) True / False (b) True / False (c) True / False	 1 1 1
11.	There are x candies and they are evenly distributed to 6 children. If there are 6 more candies and 3 more children, each child will get at least 3 less candies. Find the least value of x.	11. _____	2
12.	Consider the following positive integers: 4, 4, 5, 6, m, n If the mean of the above data is 4, which of the following is/are true? I. $m + n = 5$ II. Median of the data = 5.5 III. Mode of the data = 4	12. _____	2
13.	A job interview is divided into three parts I, II and III. The table below shows the marks obtained by Mary and John in each part. It is given that the weighted mean mark of John is 63.5. Find the weighted mean mark of Mary.	13. _____	2
		Subtotal:	/14

	I	II	III
Mary's mark	90	54	60
John's mark	66	60	65
Weight	1	2	x

14.	In the figure, ABC and AED are straight lines. It is given that $AB = 4$, $BC = 5$, $AE = 6$ and $\angle ACE = \angle ADC$. Which of the following is/are true? I. $\Delta ACE \sim \Delta ADC$ II. $AE = DE$ III. $\Delta ABE \sim \Delta ACD$ 	14. _____	2
15.	In ΔABC, $AB = 3x$ cm, $BC = 16$ cm and $AC = x$ cm, where x is an integer. Find the number of solutions for x.	15. _____	2
16.	In the figure, G is the centroid of ΔABC. AD and BE intersect at G. The area of ΔBDG is 4 cm^2. Find the area of $DCEG$. 	16. _____	2
		Subtotal:	/6

Section B (60%)

All working must be clearly shown in the spaces provided.

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

18. (a) Solve the inequality $\frac{3x+1}{-4} \leq 2 - \frac{3-2x}{5}$. (3 marks)

(b) If x is an integer, write down the least possible value of x that satisfies the inequality in (a). (1 mark)

19. Alan and Ken are given \$40 and \$25 as pocket money respectively every day. After their parents increase their pocket money, Alan's pocket money does not exceed 1.5 times that of Ken. If the total increase in their pocket money is \$12, find Alan's maximum possible daily pocket money. (4 marks)

20. The table shows the distribution of the hourly wages of the workers in a factory.

Hourly wage	\$29	\$31	\$32	\$60	\$113
Number of workers	6	5	5	2	1

The factory owner claims that the average hourly wage of the workers exceeds \$35.

(a) What kind of average does the owner suggest? Justify your answer. (3 marks)

(b) Do you think the average used by the owner is appropriate to reflect the hourly wage of the workers in the factory? Explain your answer. (1 mark)

21. (a) Factorize

(i) $3x^2 - x - 4$.

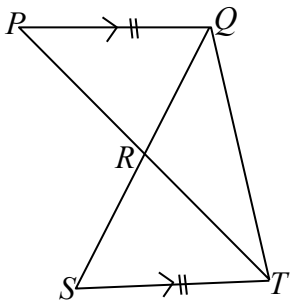
(ii) $18x^4 - 32$. (3 marks)

(b) Hence or otherwise, factorize $18x^4 - 32 - 6x^3 - 8x$. (3 marks)

22. If n is an integer and $a > 1$, simplify $\dfrac{a^{n-2} + a^{n-3}}{a^{n-2} - a^n}$ and express the answer with positive indices.

(3 marks)

23. In the figure, PRT and QRS are straight lines. $PQ = ST$ and $PQ \parallel ST$.



(a) Prove that $\Delta PQR \cong \Delta TSR$. (2 marks)

(b) Prove that $QR = RS$. (1 mark)

(c) It is given that QS is the angle bisector of $\angle PQT$.

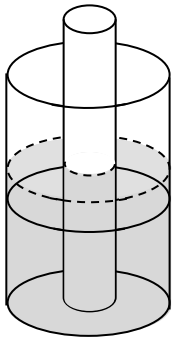
(i) Prove that $\Delta PQR \cong \Delta TQR$.

(ii) Hence, prove that QR is perpendicular bisector of ΔPQT.

(5 marks)

24. The perimeter of sector AOB is 50 cm and $\angle AOB = 60°$, where O is the centre. Find the area of the sector AOB, correct to 3 significant figures. (4 marks)

25. A cylindrical metal pillar, with base radius 6 cm, stands upright on the base of the cylindrical vessel, with base diameter 24 cm, and the pillar is taller than the vessel, as shown in the figure. The original depth of water is 15 cm. If 108π cm^3 of water is added into the vessel, find



(a) the rise in the water level; (3 marks)

(b) the percentage increase in the area of the wet curved surface of the pillar. (Give the answer correct to 3 significant figures if necessary.) (3 marks)

26. The base radius and the height of a cylinder are r cm and 19 cm respectively. Suppose its height is increased by 12.5% and its volume is then decreased by 28%.

(a) Let y cm be the radius of the cylinder after the change. Express y in terms of r. (4 marks)

(b) Hence, find the percentage change in the radius of the cylinder. (2 marks)

27. David borrowed \$100 000 from a bank at 9% p.a. compounded monthly. He agreed to repay \$$x$ each month.

(a) How much did David owe the bank for the 1st month **before** paying the 1st instalment? (2 marks)

(b) Express, in terms of x, the amount that David still owes the bank **after** paying the 2nd instalment. (2 marks)

(c) David just repaid half of the original loan from the bank **after** paying the 2nd instalment. Find the amount of each repayment. (Give the answer correct to the nearest dollar.) (2 marks)

28. The development of public housing in a city is under study. It is given that

the total floor area of public housing flats at the end of a particular year
= the total floor area of public housing flats at the end of the previous year × (1+ 10%) – 3.2 million m^2

It is found that the total floor area of public housing flats at the end of the 1st year is 9×10^7 m^2.

(a) Express 3.2 million in scientific notation. (1 mark)

(b) Find the total floor area of public housing flats at the end of the 2nd year and express the answer in scientific notation. (2 marks)

(c) It is known that the total floor area of public housing flats needed at the end of the 4th year is 1.1×10^8 m^2. A researcher claims that, at the end of the 4th year, the total floor area of public housing flats will be greater than the total floor area of the public housing flats needed. Is the claim correct? Explain your answer. (3 marks)

End of Paper