ST. STEPHEN'S GIRLS' COLLEGE

Final Examination 2019 – 2020

Form 3 **MWC, WYL, SCHL**

143 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.

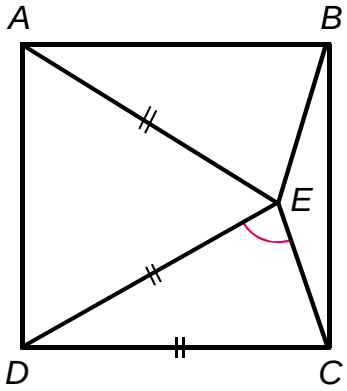
4. The diagrams in this paper are not necessarily drawn to scale.

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	(4)	(4)
20 – 21	(8)	(8)
22 – 23	(8)	(9)
24 – 25	(7)	(12)
TOTAL		(100)

Section A (40%)

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

		Answers	**Marks**
1.	Factorize the following polynomials. (a) $2m^2 - m - 3$ (b) $6m^2 - 13mn + 6n^2$ (c) $r^2 + 12r + 36 - s^2$	1. (a) _____ (b) _____ (c) _____	 2 2 2
2.	Simplify $\dfrac{5ab^2}{(3a^2b^{-2})^{-2}}$ and express your answer with positive indices.	2. _____	2
3.	Round off the following numbers to 3 significant figures and express the results in scientific notation. (a) 31415926.5 (b) −0.00032610	3. (a) _____ (b) _____	 1 1
4.	Convert the decimal number $10 \times 2^{28} + 48$ to a hexadecimal number.	4. _____	2
5.	Solve the inequality $\dfrac{m}{3} - 2 \geq \dfrac{m}{8}$.	5. _____	2
6.	If $p \geq q$, which of the following is/are true? I. $p - 2 \geq q - 2$ II. $-\dfrac{p}{5} \leq -\dfrac{q}{5}$ III. $\dfrac{2}{p} \leq \dfrac{2}{q}$	6. _____	2
7.	In the figure, $ABCD$ is a square. E is a point in the square such that $DE = DC = AE$. Find $\angle DEC$.  	7. _____	2

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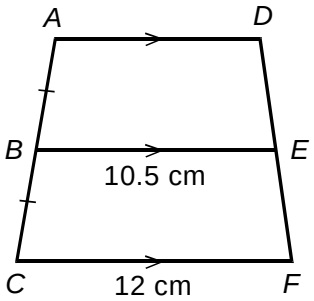
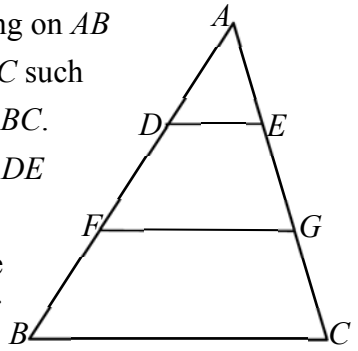
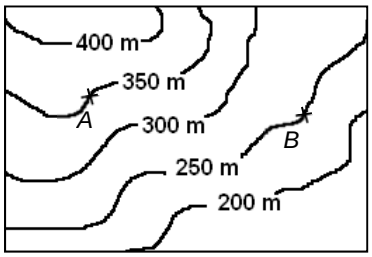
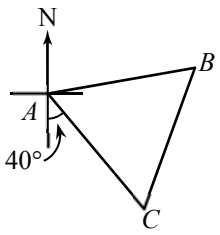
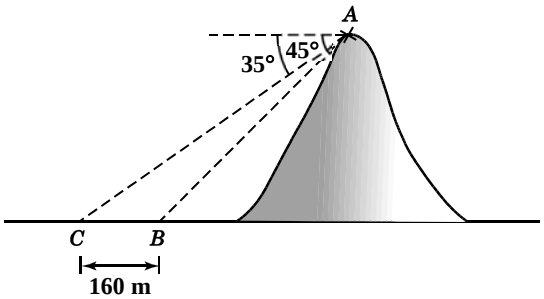
8.	In the figure, ABC and DEF are straight lines. $AD \parallel BE \parallel CF$. It is given that $BE = 10.5$ cm and $CF = 12$ cm. Find the length of AD. 	8. _____	2
9.	In the figure, D and F are points lying on AB while E and G are points lying on AC such that $AD = DF = FB$ and $DE \parallel FG \parallel BC$.  (a) Find the ratio of the area of ΔADE to the area of ΔABC. (b) Find the ratio of the area of the trapezium $DFGE$ to the area of the trapezium $FBCG$.	9. (a) _____ (b) _____	2 2
10.	In the figure, the scale of the contour map is 1 : 40 000. AB is a straight road. AB is measured to be 2 cm on the map. Find the inclination of road AB, correct to 3 significant figures. 	10. _____	2
11.	In the figure, ABC is an equilateral triangle. The compass bearing of C from A is S40°E. Which of the following is/are true? I. The compass bearing of A from C is N60°W. II. The true bearing of C from B is 200°. III. The compass bearing of A from B is S80°W. 	11. _____	2
12.	In the figure, the angles of depression of two points B and C on the horizontal ground from peak A are 45° and 35° respectively. A, B and C lie on the same vertical plane. If the distance between C and B is 160 m, find the height of the hill. (Give your answer correct to 3 significant figures.) 	12. _____	2

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13.	The coordinates of the points A and B are $(-10, 0)$ and $(30, 0)$ respectively. Consider a point G with y-coordinate -15 such that $AG = GB$. Find the coordinates of G.	13. _____	2
14.	The three points $A(3, -2)$, $B(a, -4)$ and $C(-1, 6)$ are collinear. Find the value of a.	14. _____	2
15.	L_1 is a straight line with slope -1. L_2 is a straight line perpendicular to L_1 and L_2 cuts the x-axis at $(5, 0)$. If L_2 cuts the y-axis at P, find the coordinates of P.	15. _____	2
16.	Two fair dice are rolled. Find the probability that the sum of the two numbers is a multiple of 8.	16. _____	2
17.	There are 3 brands of instant noodles on the shelf of a supermarket. 40% are brand A noodles, 25% are brand B noodles and 35% are brand C noodles. It is given that the selling prices of each pack of brand A, brand B and brand C noodles are \$3, \$2.6 and \$4 respectively. If a pack of instant noodles is drawn at random from the shelf, find the expected value of the selling price of the pack of instant noodles.	17. _____	2

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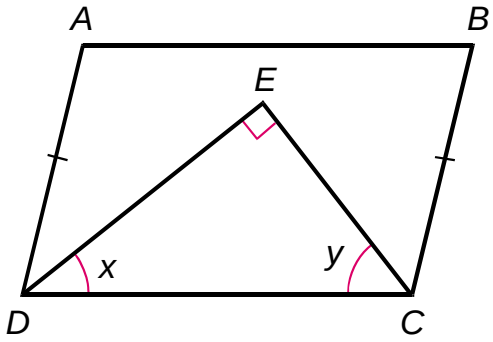
Section B (60%)

All working must be clearly shown in the spaces provided.

18. (a) Solve $\frac{9(1-x)}{4} < 2x - \frac{1}{9}$. (3 marks)

(b) Find the smallest possible integer x that satisfies the inequality in (a). (1 mark)

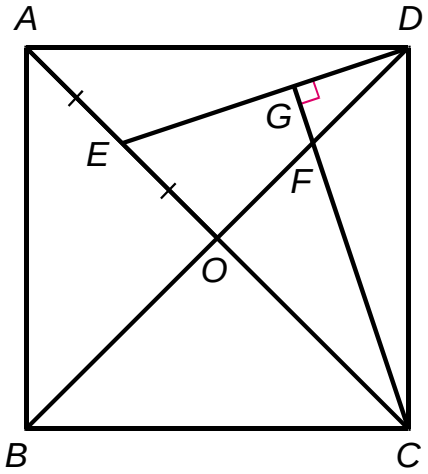
19. In the figure, $ABCD$ is a quadrilateral. The angle bisector of $\angle BCD$ and the angle bisector of $\angle ADC$ intersect at E. $DE \perp CE$ and $AD = BC$.



(a) Prove that $x + y = 90°$. (1 mark)

(b) Prove that $ABCD$ is a parallelogram. (3 marks)

20. In the figure, $ABCD$ is a square. AC and BD intersect at O. E is the mid-point of AO. G is a point on ED such that $CG \perp DE$. CG and DO intersect at F.

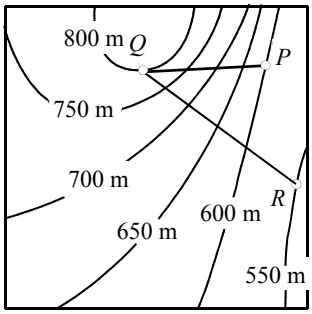


(a) Prove that $\angle GDF = \angle OCF$. (2 marks)

(b) Prove that $\Delta EDO \cong \Delta FCO$. (3 marks)

(c) Prove that $EF = \frac{1}{2} AD$. (3 marks)

21. The figure shows a part of a contour map of scale 1 : 8 000. PQ represents a straight path. The length of PQ on the map is measured as 1.6 cm.



(a) Find the gradient of PQ. (3 marks)

(b) Find the actual length of PQ, correct to 3 significant figures. (2 marks)

(c) R is a point on the map. If the length of the straight path QR on the map is measured as 2.5 cm, which path is steeper, PQ or QR? Explain your answer. (3 marks)

22. Figure (a) shows a plastic right circular cone with base radius 20 cm and height 30 cm. The cone is now cut into 2 parts, A and B, where A is a frustum and B is a circular cone of base radius 15 cm.

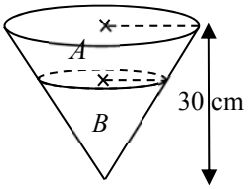


Figure (a)

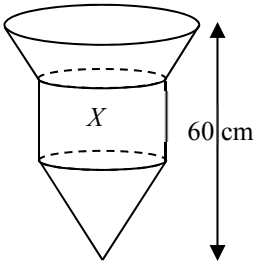


Figure (b)

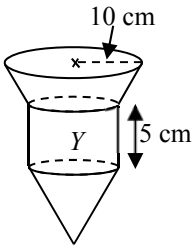


Figure (c)

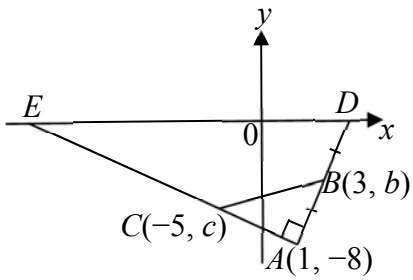
(a) Find the height of frustum A. (2 marks)

(b) A new container X is formed by inserting a cylindrical part between A and B. The height of X is 60 cm, see figure (b).

(i) Now 6862.5π cm^3 of water is poured into X. Find the height of water inside X. (3 marks)

(ii) Peter creates another solid Y as shown in figure (c) by using a similar circular cone. Do you think solid Y is similar to solid X? Explain your answer. (3 marks)

23. In the figure, $A(1, -8)$, $B(3, b)$ and $C(-5, c)$ are the vertices of a triangle, where $CA \perp AB$. AB is produced to cut the x-axis at D and $AB = BD$. AC is produced to cut the x-axis at E. Find

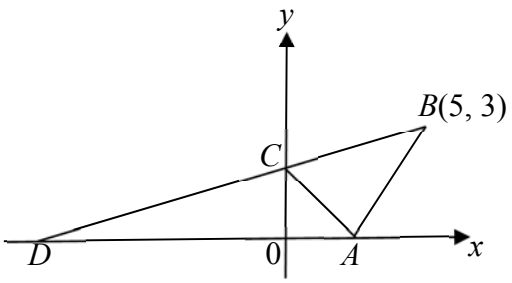


(a) the coordinates of B and D, (3 marks)

(b) the coordinates of C, (2 marks)

(c) the area of quadrilateral $BDEC$. (4 marks)

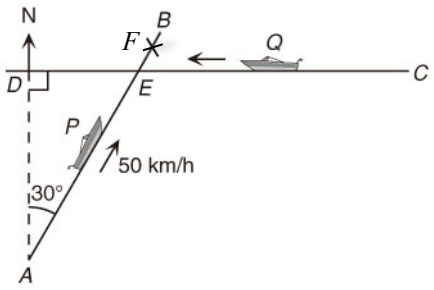
24. In the figure, $B(5, 3)$, C and A are the vertices of a triangle, where C lies on the y-axis and A lies on the x-axis. BC is produced to meet the x-axis at D. It is given that $DC : CB = 2 : 1$.



(a) Find the coordinates of C and D. (4 marks)

(b) Given that the area of ΔABC is 7 square units, find the coordinates of A. (3 marks)

25. In the figure, ship P sails in the direction N30ºE at 50 km/h from A along route AB. At the same time, ship Q sails due west from C along route CD at a constant speed. Suppose D is due north of A, $AD = 10$ km and $CD = 20$ km.



(a) (i) If the two ships meet at E, find AE and DE. (Leave your answers in surd form if necessary.) (3 marks)

(ii) Hence, find the speed of ship Q. (Give your answers correct to 3 significant figures.) (3 marks)

(b) If the two ships continue to sail without changing their speeds, ship P arrives at F when ship Q arrives at D.

(i) Find the shortest distance from F to route CD. (3 marks)

(ii) Find the true bearing of F from D. (3 marks)

(Give your answers correct to 3 significant figures.)

End of Paper