St. Stephen's Girls' College Final Examination 2017-2018

Form 3 156 students

MWC, WYL, SCHL

MATHEMATICS Paper I Time Allowed: 1 hour 30 minutes

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Name: _____ (

Class: _____

Instructions:

- Attempt *ALL* questions.
- Write your answers in the spaces provided in this *Question-Answer Paper*.
- *ALL* working must be clearly shown.
- The diagrams in this paper are not necessarily drawn to scale.
- This paper carries 100 marks.

Question No.	Marks
1	(3)
2	(4)
3	(4)
4	(5)
5	(5)
6	(7)
7	(7)

Question No.	Marks
8	(7)
9	(8)
10	(8)
11	(10)
12	(11)
13	(10)
14	(11)
Total	(100)

F3 Mathematics Paper 1 Final Examination 2017-2018
1. Simplify
$$\frac{(p^{-3}q^{2})^{4}}{(p^{-2}q^{4})^{-2}}$$
 and express the answer with positive indices. (3 marks)
2. Factorize
(a) $25q^{2} + 20ab + 4b^{2}$,
(b) $25a^{2} + 20ab + 4b^{2} - 5ac - 2bc$. (4 marks)
3. (a) Solve the inequality $-6 > \frac{2-x}{4} + x$.
(b) If x is an integer, find the greatest possible value of x satisfying the inequality in (a). (4 marks)

- 4. In the figure, *OAB* and *OCD* are sectors with centre *O* where OA = 5 cm and OD = 10 cm.
 - (a) If $\overrightarrow{AB} = 2\pi$ cm, find θ .
 - (b) Find the area of the shaded region and give the answer in terms of π . (3 marks)

5. The figure shows a circle with centre *O* and radius 5 cm. *A* and *B* are points on the circle where AB = 8 cm. If *M* is the mid-point of *AB*, find

- (a) *OM* and $\angle AOM$,
- (b) the area of the shaded region.(Correct to 3 significant figures if necessary.)





(2 marks)

- 6. The figure shows a circular target with *O* as its centre. *B* and *C* are points on the circumference of the target. It is given that $AB \perp OC$, *A* is the mid-point of *OC* and AB = 6 cm. John shoots an arrow randomly and it hits the target.
 - (a) Find *OB*. (Leave the radical sign ' $\sqrt{}$ ' in the answer if necessary.)



(b) Find the probability that the arrow hits the shaded region, correct to 3 significant figures. (4 marks)

7. In a game, a participant draws a ball from a box which contains *n* white balls, 5 black balls and 8 red balls. If a ball is randomly drawn from the box, then the probability of drawing a red ball is ²/₅. \$x will be awarded if a black ball is drawn, \$5 will be awarded if a red ball is drawn, and no prize will be given if a white ball is drawn.
(a) Find the value of *n*.
(b) Find the expected value of the prize if x = 10.
(c) If a participant has to pay \$8 to play the game once, find the minimum value of x if x is an integer,

such that the game is favorable to the participant. (3 marks)

- 8. In the figure, *ADF*, *BEF* and *CED* are straight lines. It is given that $\angle EBC = \angle EFD$.
 - (a) (i) Prove that AF //BC.(1 mark)(ii) Prove that $\Delta BCE \sim \Delta FDE$.(2 marks)(b) It is given that AF = 12, BC = 8, BE = 14and EF = 7.(i) Find the length of DF.(2 marks)
 - (ii) Hence, prove that *ABCD* is a parallelogram.



9. In the figure, ΔPQR is an isosceles triangle where *R* is a point on the *y*-axis and PR = QR. *T* is a point inside ΔPQR .



- 10. In the figure, it is given that the straight line L_1 cuts the *x*-axis and *y*-axis at A(-2, 0) and B(0, 4) respectively. The straight line L_2 , passing through *B* and perpendicular to L_1 , cuts the *x*-axis at *C*.
 - (a) Find the coordinates of C. (2 marks)
 - (b) D is a point on BC and the coordinates of D are (1.6, 3.2).
 - (i) Show that AB // OD. (2 marks)
 - (ii) Write down a pair of similar triangles in the figure.
 - (1 mark)
 - (iii) Hence, find the ratio of the area of $\triangle ODC$ to the area of quadrilateral *OABD*. (3 marks)



In the figure, ABCD is a rhombus. Its diagonals BD and AC intersect at K. DC and AC are produced to M and N respectively such that MN // BD and 2MN = BD. MK cuts BC at H.

(a) Prove that <i>MNDK</i> is a (b) Prove that $\Delta HCK \sim \Delta$. (c) Hence, prove that <i>BH</i>	parallelogram. DAN. = 2HC.	(3 marks) (3 marks) (4 marks)	M	C H B

- 12. The figure shows a map in the scale of 1 : 20 000 where AB = 2.5 cm and AC = 1.5 cm on the map.
 - (a) Find the inclination of *AB*, correct to 3 significant figures. (3 marks)
 - (b) Which path, *AB* or *AC*, is steeper? Explain your answer. (3 marks)
 - (c) If the actual length of *BC* is shorter than the sum of the actual lengths of *AB* and *AC* by 100 m, find the length of *BC* on the map and the gradient of *BC*, correct to 3 significant figures. (5 marks)



13. Figure (a) shows a right circular cone of base radius 10 cm and height 3.87 cm. The cone is melted and recast into Part (I) of a frustum as shown in Figure (b). This frustum is made by cutting off the lower part of an inverted right circular cone of base radius *r* cm and height 10 cm. The height of the frustum formed is 5 cm and the height of Part (I) of the frustum is 3 cm.



- (a) Find the volume of the right circular cone. (Give the answer in terms of π .) (2 marks)
- (b) Let *x* cm and *y* cm be the upper base radius and lower base radius of Part (I) of the frustum as shown in Figure (b) respectively.
 - (i) Express x and y in terms of r. (3 marks)
 - (ii) Express the volume of inverted right circular cones *ADE* and *AFG* in terms of *r* and π .
 - (iii) Find the value of r.(3 marks)(2 marks)

- 14. In the figure, *P* and *Q* are two points on the shore. *P* is 1200 m due north of *Q*. A boat is originally anchored at point *R*. The compass bearings of *P* and *Q* from *R* are N70°W and S30°W respectively.
 - (a) Find the shortest distance between *R* and the shore, correct to 3 significant figures. (5 marks)
 - (b) Find the distance between *P* and *R*, correct to 3 significant figures. (2 marks)
 - (c) The boat now sails due north to another point *T*. It is given that PT = PR. Find the compass bearing of *T* from *Q*, correct to 3 significant figures. (4 marks)


