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

**Form 3** **MWC, WYL, SCHL**
**156 students**

**MATHEMATICS**
**Paper II**
**Time Allowed : 1 hour 15 minutes**

**Name: _____ Class No.: _____ Class: _____ Marks: _____**

**Please read the following Instructions very carefully.**

- *Answer **ALL** questions in the spaces provided in this **Question-Answer Paper**.*
- *All rough work should be done on the rough work paper provided, but will not be marked.*
- *Unless otherwise specified, **numerical answers should be either exact or correct to 3 significant figures**.*
- *The diagrams in this paper are not necessarily drawn to scale.*
- ***This paper carries 100 marks.***

| | | Answers | Marks |
|---|---|---|---|
| 1. | Factorize the following:<br>(a) $x^2 - 9y^2$<br>(b) $2x^2 + 5x - 12$ | 1.<br>(a) _____<br>(b) _____ | <br>2<br>2 |
| 2. | Simplify the following expressions and express the answers with positive indices.<br>(a) $4a^0 \times (2a)^{-1}$<br>(b) $8^{n+1} \div 4^n$ | 2.<br>(a) _____<br>(b) _____ | <br>2<br>2 |
| 3. | Calculate $4000 \times 0.0003 \div 100$ and give the answer in scientific notation. | 3.<br>_____ | <br>2 |
| 4. | Convert the decimal number $2^8 + 2^7 + 70$ to a binary number. | 4.<br>_____ | <br>2 |
| 5. | If $a < b < 0$, determine whether the following inequalities are true or false. Circle the correct answers.<br>(a) $a^2 < b^2$<br>(b) $\frac{1}{a} > \frac{1}{b}$<br>(c) $-3a > -2b$ | 5.<br>(a) True / False<br>(b) True / False<br>(c) True / False | <br>1<br>1<br>1 |
| 6. | Solve the following inequalities.<br>(a) $6x - 7(x-1) \geq 5$<br>(b) $\frac{x}{4} - 1 < \frac{2x}{7}$ | 6.<br>(a) _____<br>(b) _____ | <br>2<br>2 |
| 7. | There are some \$2 coins and \$5 coins in a bag. If the number of \$5 coins is greater than that of \$2 coins by 3, and the total value of the coins is not less than \$100, at least how many \$5 coins are there in the bag? | 7.<br>_____ | <br>3 |
| 8. | The value of a car depreciates at a constant rate of 10% every year. If its present value is \$120 000, find the value of the car after 4 years. | 8.<br>_____ | <br>2 |
| 9. | A sum of \$35 000 is deposited at an interest rate of 10% per annum for 4 years, compounded quarterly. Find the interest correct to the nearest dollar. | 9.<br>_____ | <br>2 |
| 10. | The rateable value of a flat is \$100 000. If the rates percentage charge is 5%, find the quarterly rates payable of the flat. | 10.<br>_____ | <br>2 |

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11. Which of the following CANNOT be the probability of an event happening?

$\frac{\pi}{4}$, 0, 1, $-\frac{1}{7}$, $\frac{1}{\sqrt{2}}$, $0.\dot{3}$

11. _____ 2

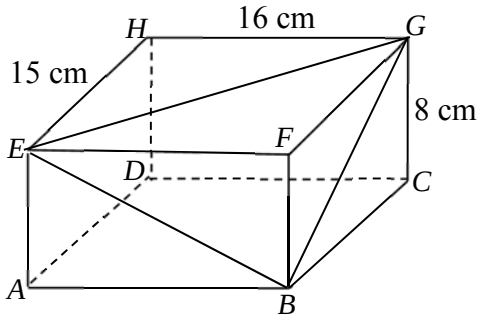
12. Find the total surface area of a hemisphere of radius 6 cm in terms of $\pi$.

12. _____ 2

13. Find the volume of a right circular cone of base radius 8 cm and slant height 17 cm in terms of $\pi$.

13. _____ 2

14. *ABCDHEFG* is a cuboid with dimensions of 15 cm × 16 cm × 8 cm. Find the volume of the pyramid *EGBF*.



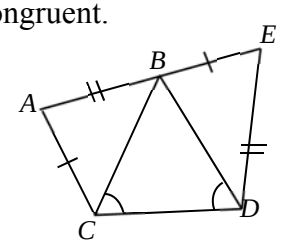

14. _____ 2

15. It is known that the lengths of two sides of a triangle are 7 and 11 respectively. Which of the following is/are the possible length of the remaining side?
A. 2 B. 3 C. 4 D. 5

15. _____ 2

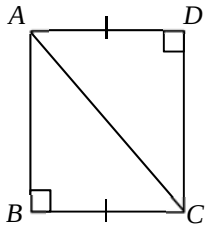
16. Determine which of the following pairs of triangles is/are congruent.

I.



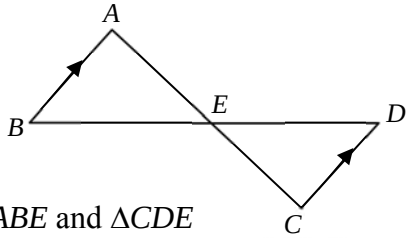

$\Delta ABC$ and $\Delta EDB$

II.




$\Delta ABC$ and $\Delta CDA$

III.



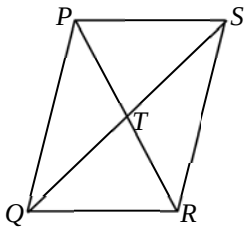

$\Delta ABE$ and $\Delta CDE$
(*AEC* and *BED* are straight lines)

16. _____ 2

12

17. In the figure, $PQRS$ is a parallelogram. $PR$ and $QS$ intersect at $T$. Which of the following must be true?
Circle the correct answers.

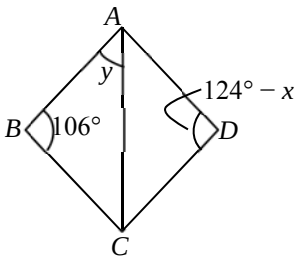
I. $PT = TR$
II. $\angle PQR = \angle PSR$
III. $\Delta PTS \cong \Delta RTQ$




17.

I. True / False 1
II. True / False 1
III. True / False 1

18. In the figure, $ABCD$ is a rhombus. Find the unknowns.




18.

$x =$ _____ 1

$y =$ _____ 1

19. 5 coins are tossed together several times. The number of tails obtained is recorded as follows.

| Number of tails | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Frequency | 10 | 62 | 78 | 74 | 64 | 12 |

Find the experimental probability of getting at least 3 tails.

19.

_____ 2

20. The table shows the number of mistakes made by a group of candidates who took a driving test.

| Number of mistakes | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Number of candidates | 2 | 34 | 14 | 43 | 7 |

Find the mean, median and mode of the number of mistakes made by these candidates .

20.

Mean = _____ 1

Median = _____ 1

Mode = _____ 1

21. The following table shows Alan's marks in three mathematics tests and the weight of each test.

| | Test 1 | Test 2 | Test 3 |
|---|---|---|---|
| **Mark** | 70 | 60 | 88 |
| **Weight** | 2 | 5 | 4 |

Find Alan's weighted mean mark.

21.

_____ 2

12

22. The slopes of four straight lines $L_1$, $L_2$, $L_3$ and $L_4$ are given in the following table.

| Straight line | $L_1$ | $L_2$ | $L_3$ | $L_4$ |
|---|---|---|---|---|
| Slope | $-3$ | $\frac{-1}{3}$ | $\frac{1}{3}$ | 3 |

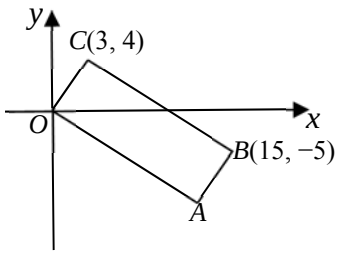
Which of the following must be true? Circle the correct answers.

I. $L_1$ is perpendicular to $L_3$.
II. $L_1$ is steeper than $L_2$.
III. $L_3$ is steeper than $L_4$.

22.

I. True / False 1
II. True / False 1
III. True / False 1

23. In the figure, find the area of rectangle $OABC$.

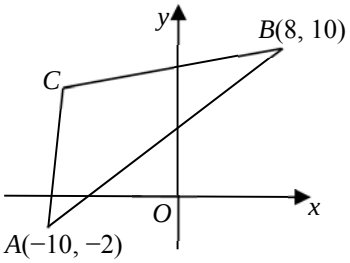



23. _____ 3

24. $A(-3, 2)$, $B(1, -6)$ and $C(5, -4)$ are three points in a rectangular coordinate plane. If $D$ is a point on the $y$-axis such that $AB$ // $DC$, find the coordinates of $D$.

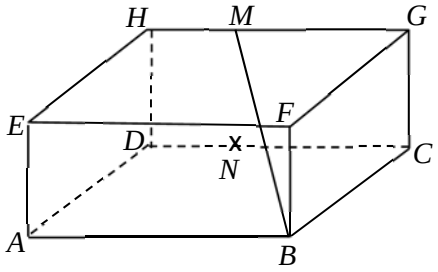
24. _____ 2

25. In the figure, $A(-10, -2)$, $B(8, 10)$ and $C$ are the vertices of a triangle. It is given that $M(-9, 3)$ is the mid-point of $AC$. $P$ is a point on the line segment $AB$ such that $AP : PB = 1 : 2$. Find the coordinates of $C$ and $P$.




25. $C$ : _____ 2
$P$ : _____ 2

26. The figure shows a rectangular block where $MN \perp DC$.




Write down
(a) the projection of $BM$ on the plane $FBCG$;
(b) the angle between $BM$ and the plane $HGCD$.

26.

(a) _____ 2
(b) _____ 2

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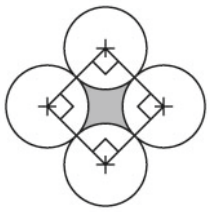
27. The figure shows 4 identical circles. If the perimeter of the shaded region is $4\pi$ cm, find the area of the shaded region, correct to 3 significant figures.



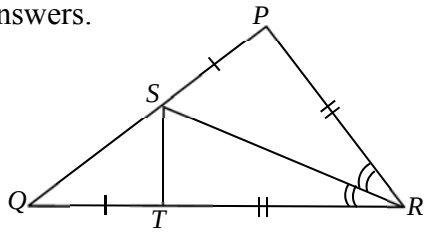
27. _____ 3

28. Two cards are drawn randomly at the same time from five cards numbered 2, 3, 5, 7 and 9 respectively. Find the probability that the sum of the numbers on the cards drawn is divisible by 3.

28. _____ 3

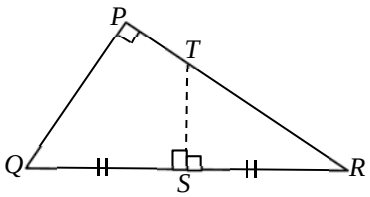
29. In the figure, $PSQ$ and $QTR$ are straight lines. $SR$ bisects $\angle PRT$, $PR = RT$ and $PS = QT$. Which of the following must be true? Circle the correct answers.

I. $SR$ bisects $\angle PST$.
II. $\angle SPR = 2\angle TQS$.
III. $\Delta QPR \sim \Delta QTS$.




29.
I. True / False 1
II. True / False 1
III. True / False 1

30. In the figure, $QSR$ and $PTR$ are straight lines.




(a) Write down the orthocentre of $\Delta PQR$.

(b) Which of the following must be true?
Circle the correct answers.
(i) The circumcentre of $\Delta PQR$ lies on $TS$.
(ii) $PS = QS = RS$.

30.
(a) _____ 1

(b)(i) True / False 1
(ii) True / False 1

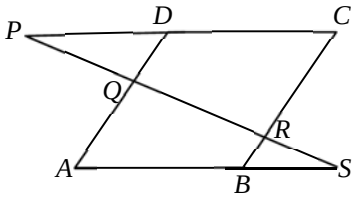
31. Pier $B$ is 12 km due north of lighthouse $A$. A boat sails from $B$ at a speed of 10 km/h in the direction of S$x$°E. The boat is closest to $A$ after half an hour. Find $x$, correct to 3 significant figures.

31. _____ 3

32. If the height and the base radius of a right circular cone are increased by 20% and $x$% respectively so that its volume is increased by 170%, find $x$.

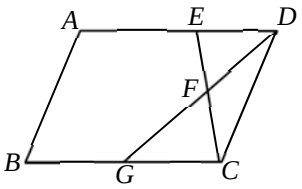
32. _____ 3

33. In the figure, $ABCD$ is a parallelogram. $B$ and $D$ are points on $AS$ and $PC$ respectively such that $PD : DC = 2 : 3$ and $AB : BS = 4 : 1$. If $PS$ intersects $AD$ and $BC$ at $Q$ and $R$ respectively, find the area of $\Delta DQP$ : the area of $\Delta BRS$.




33. _____ 3

34. In the figure, $ABCD$ is a parallelogram. $E$ is a point on $AD$ such that $AE : DE = 2 : 1$. $G$ is the mid-point of $BC$. $CE$ and $DG$ intersect at $F$. If the area of $\Delta DEF$ is 4 cm$^2$, find the area of $ABCD$.

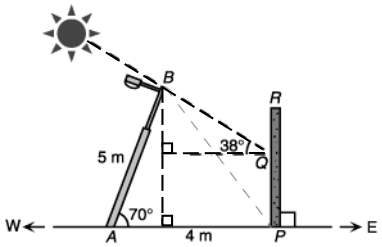



34. _____ 2

35. It is given that $a$ is a positive constant. The coordinates of $P$ and $Q$ are $(5a, 0)$ and $(0, 2a)$ respectively. Let $R$ be a point lying on the $y$-axis such that the $x$-coordinate of the orthocentre of $\Delta PQR$ is 10. Find the $y$-coordinate of $R$.

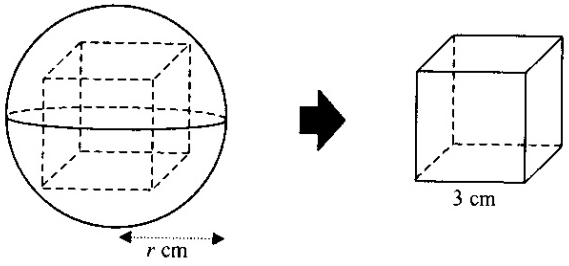
35. _____ 3

36. In the figure, a lamp post $BA$ of length 5 m is leaning to the east and makes an angle of 70° with the horizontal ground. $RP$ is a vertical wall. In the late afternoon, the sun shines from the west. At one moment, the lamp post casts part of its shadow on the ground $AP$ and part of the shadow $PQ$ on the wall $RP$. If $AP$ = 4 m and the angle of elevation of the sun from $Q$ is 38°, find the length of $PQ$ correct to 3 significant figures.




36. _____ 3

37. In the figure, a solid wooden sphere of radius $r$ cm is to be cut into a cube of side 3 cm. If the cube can just fit into the sphere, find the curved suface area of the sphere in terms of $\pi$.




37. _____ 3

**End of Paper**

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