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

Form 2   **LC, WMC, LL, WYL, CYN**
170 students   **MATHEMATICS**
Paper I
Time Allowed: 1 hour 30 minutes

Name: _____ **No.:** _____

Class: _____   **Division:** _____

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.*

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

Question No.	Marks	Question No.	Marks
1		10	
2		11	
3		12	
4		13	
5		14	
6		15	
7		16	
8		17	
9		18	
		Total:	

1. If $(x + y) : 3 = (2y - x) : 4$, find $x : y$.   (3 marks)

2. (a) Make a the subject of the formula $\dfrac{5a-1}{2} = a + b(a+1)$.   (4 marks)

    (b) Find the value of a when $b = 2$.   (1 mark)

3. If A and B are constants such that $Ax(x-5) - x^2 \equiv Bx(x+6) - 93x$, find the values of A and B.   (4 marks)

4. In $\triangle ABC$, $BA = BC$ and $\angle A = 2\angle B = x$. Find x.   (5 marks)

5. It is given that the sum of interior angles of an n-sided polygon is 9 times that of its exterior angles. Find the value of n.   (4 marks)

6. The following tables show the recorded time, correct to the nearest second, for 100 athletes to cover a lap of a running track.

Cumulative frequency table:

Recorded time less than (s)	69.5	74.5	79.5	84.5	89.5	94.5	99.5
Number of athletes						94	100

Frequency distribution table:

Recorded time (s)	70 – 74	75 – 79	80 – 84	85 – 89	90 – 94	95 – 99
Class Mark (s)						
Number of athletes	8	20	24	32	10	6

(a) Complete the cumulative frequency table and the frequency distribution table above. (2 marks)

(b) According to the information in (a), draw the corresponding frequency polygon.   (5 marks)
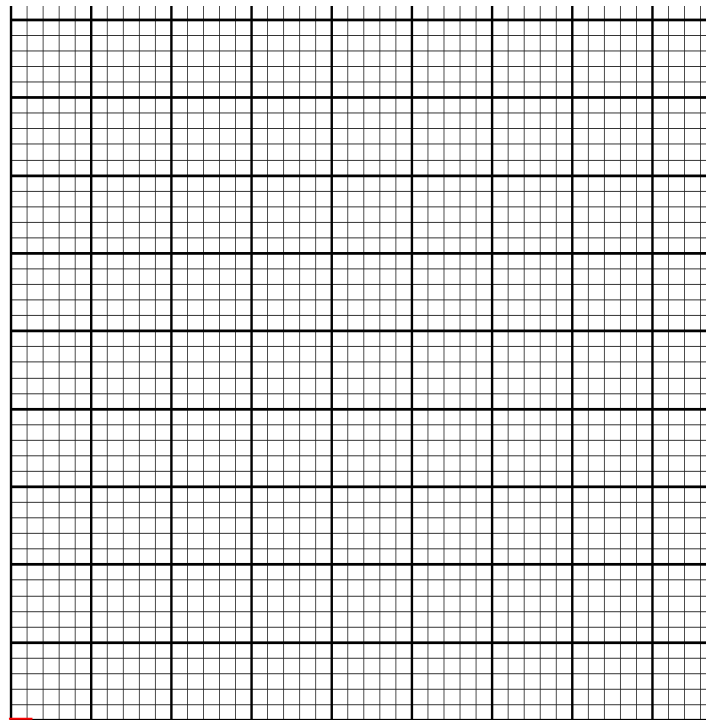
(c) To qualify for an international athletic competition, an athlete needs to have a lap time of less than 79.5 seconds. Find the percentage of athletes who are not qualified for the competition.

(2 marks)

7. It is given that the graph of the equation $ax + y - 7 = 0$
    passes through $P(2, 1)$.
    (a) Find the value of a.   (2 marks)
    (b) If the graph cuts the y-axis at $B(0, b)$, find the value
         of b.   (2 marks)
    (c) l is a line parallel to the x-axis. l cuts the y-axis at A and
         passes through P. Find the area of ΔABP.   (2 marks)

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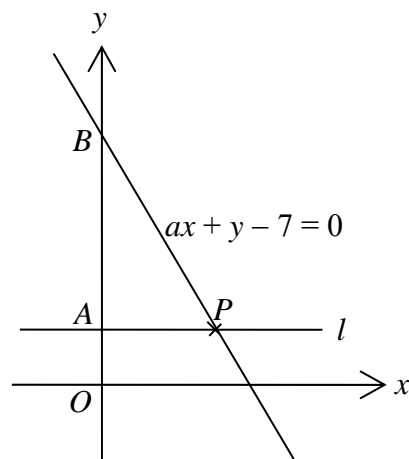
8. (a) Factorize $-27a - 3$.   (1 mark)
    (b) Factorize $9ab + 18a + b + 2$.   (2 marks)
    (c) Using the results of (a) and (b), factorize $9ab + 18a + b + 2 - 27a - 3$.   (3 marks)

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9. In the figure, $\angle B = 90°$, AD = 53 cm and CD = 28 cm. It is given that $AB : BC$ = 3 : 4 and the perimeter of $ABCD$ is 144 cm.
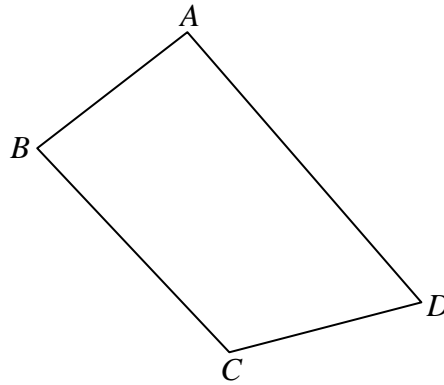
(a) Find the length of AB.   (2 marks)
(b) Is $\triangle ACD$ a right-angled triangle? Explain your answer.   (5 marks)
(c) Find the area of $ABCD$.   (2 marks)

10. (a) Expand and simplify $\sqrt{a}\left(\sqrt{a}+\sqrt{12b}\right)$. (2 marks)

    (b) Write down a pair of values for *a* and *b* such that $\sqrt{a}\left(\sqrt{a}+\sqrt{12b}\right)$ is a rational number.

(1 mark)

11. Simplify $\dfrac{9}{\sqrt{5}}\times\sqrt{\dfrac{35}{18}}$ and rationalize the denominator of the result if necessary. (4 marks)

12. In the figure, ΔABC and ΔADC are two right-angled triangles. It is given that $\angle DAC = 22°$, $BC = 5$ and $CD = 2$. Find
    (a) the length of AC,   (2 marks)
    (b) $\angle ABC$,   (2 marks)
    (c) the length of AB.   (2 marks)

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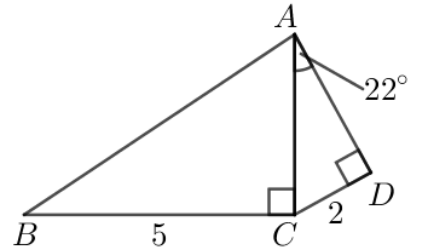
13. It is given that $\cos\theta : \sin\theta = 5 : 12$.

(a) Find the values of $\cos\theta$, $\sin\theta$ and $\tan\theta$.   (6 marks)

(b) By using the result in (a), find the value of $\dfrac{2\tan(90° - \theta)}{\cos\theta} - \dfrac{5}{\cos(90° - \theta)}$.   (2 marks)

14. It is given that $0° < \theta < 90°$.

(a) Prove the identity $\tan(90° - \theta) + \tan\theta \equiv \dfrac{1}{\sin\theta\cos\theta}$. (3 marks)

(b) Is it possible to have a value of θ such that $\tan(90° - \theta) + \tan\theta = \dfrac{1}{2}$? Explain your answer.

(2 marks)

15. In the figure, a vertical pole *PQ* with length *h* m is
    fixed on the horizontal ground *AB*. It is known
    that *AB* = 6 m, ∠*PAB* = 45° and ∠*PBA* = 30°.
    (a) Express *AQ* and *QB* in terms of *h*.   (2 marks)
    (b) Find the total length of *PA* and *PB*.   (4 marks)

16. Carrot juice and apple juice are mixed to prepare Drink *A* and Drink *B*. The ratio of the volume of carrot juice to that of apple juice in Drink *A* is 3 : 2. The ratio of the volume of carrot juice to that of apple juice in Drink *B* is 3 : 7. Now, Drink *A* and Drink *B* are mixed in the ratio 1 : 2 by volume to prepare Drink *C*. Suppose the volume of Drink *A* in Drink *C* is x mL and the volume of Drink *B* in Drink *C* is $2x$ mL.
    (a) Express the volume of carrot juice in Drink *C* in terms of x. (2 marks)
    (b) Express the volume of apple juice in Drink *C* in terms of x. (2 marks)
    (c) Hence, find the ratio of the volume of carrot juice to that of apple juice in Drink *C*. (2 marks)

17. *ABCD* is a parallelogram. Let *E* be the mid-point of *AD*. If $\angle CBD = \angle DBE = x$, determine whether $\triangle ABD$ is a right-angled triangle. Explain your answer. (5 marks)

18. It is given that $3 + 3^2 + 3^3 + ... + 3^n = \dfrac{3}{2}(3^n - 1)$, where n is a positive integer greater than 1.

    (a) Find the value of $3 + 3^2 + 3^3 + ... + 3^9$. (1 mark)

    (b) It is given that $3 + 3^2 + 3^3 + ... + 3^n = A(3 + 3^3 + 3^5 + ... + 3^{n-1})$, where n can be any positive even number and A is a constant. Find the value of A.
    $\left[\text{Hint: } 3 + 3^2 + 3^3 + ... + 3^n = (3 + 3^3 + 3^5 + ... + 3^{n-1}) + (3^2 + 3^4 + 3^6 + ... + 3^n) \right]$ (2 marks)

    (c) Hence, show that $3 + 3^3 + 3^5 + ... + 3^{n-1} = \dfrac{3}{8}(3^n - 1)$ if n is a positive even number. (3 marks)

End of Paper

Page 14 of 14