Diocesan Girls' School
Secondary 6 Mock Examinations (2017-2018)
Mathematics (Compulsory Part)
Paper 2

January 2018

Time Allowed: 1 hour 15 minutes Total marks: 45

Name:_____ ( ) Class: _____ Set: _____

Instructions:

1. All questions carry equal marks.
2. Attempt ALL questions. You are advised to use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured.
3. You should mark only ONE answer for each question. If you mark more than one answer, you will receive NO MARK for that question.
4. No marks will be deducted for wrong answers.
5. Diagrams in this paper are not necessarily drawn to scale.

There are 30 questions in Section A and 15 questions in Section B. Choose the best answer for each question.

Section A

1. $\dfrac{\sqrt[3]{8b^6}}{b^{-2}} =$

   A. $8b^4$. B. $2b^4$. C. $2\sqrt{2}b^5$. D. $8b^5$.

2. The solution of $5-2x \geq 3x+10$ is

   A. $x \leq -1$. B. $x \leq 3$. C. $x \geq -1$. D. $x \geq -3$.

3. If $a = 0.2448$, find a^2 correct to 3 significant figures.

   A. 0.059 B. 0.060 C. 0.0599 D. 0.0600

4. If $\dfrac{3a+2b}{5a-b} = \dfrac{3}{2}$, find $\dfrac{a}{b}$.

   A. 9 B. $\dfrac{1}{9}$ C. $\dfrac{7}{9}$ D. $\dfrac{9}{7}$

5. Make a the subject of the formula $\dfrac{1}{b} = 1 + \dfrac{3}{a}$.

   A. $a = \dfrac{3b}{1-b}$ B. $\dfrac{b}{3b-1}$ C. $\dfrac{1-3b}{b}$ D. $3(b-1)$

6. If $a \leq b$ and $c < 0$, which of the following must be true?

   I. $a^2c \geq b^2c$ II. $-\dfrac{a}{c^2} \geq -\dfrac{b}{c^2}$ III. $a^3 - c \leq b^3 - c$

   A. I only B. II only C. I and III only D. II and III only

7. Which of the following CANNOT be an interior angle of a regular polygon?

   A. 150° B. 145° C. 140° D. 135°

8. The total weight of 10 identical books is measured to be 22 kg. If the maximum error of the measurement is 0.2 kg, find the upper limit of the weight of each book.

   A. 2.4 kg B. 2.3 kg C. 2.22 kg D. 2.21 kg

9. The selling price of 10 apples is equal to the cost of 8 apples. Find the profit / loss per cent of each apple.

A. Profit % = 20% B. Profit % = 25% C. Loss % = 20% D. Loss % = 25%

10. *a*, *b*, *c*, *d* and *e* are five integers arranged in ascending order. It is given that their mean, median and mode are 11, 12 and 8 respectively. Find the value of *e*.

A. 15 B. 14 C. 13 D. 12

11. If $f(2x+1)=\frac{x+5}{x-1}$, find $f(x)$.

A. $f(x)=\frac{x+9}{x-3}$ B. $f(x)=\frac{2x+6}{2x}$ C. $f(x)=\frac{2x+4}{2x-2}$ D. $f(x)=\frac{x+11}{x-1}$

12. If $x-\frac{1}{x}=5$, $x^3-\frac{1}{x^3}=$

A. 40. B. 130. C. 140. D. 145.

13. $\frac{x-3}{x^2-x-12}-\frac{2}{x^2-16}=$

A. $\frac{x^2-x-18}{(x+3)(x+4)(x-4)}$. B. $\frac{x^2-x-6}{(x+3)(x+4)(x-4)}$.

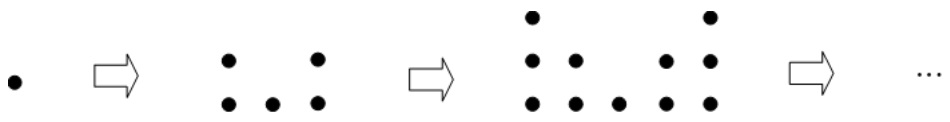
C. $\frac{x^2-9x-6}{(x+3)(x+4)(x-4)}$. D. $\frac{x^2-9x-18}{(x+3)(x+4)(x-4)}$.

14. Suppose *z* varies jointly as *x* and the square root of *y*. If *x* is increased by 8% and *y* is decreased by 20%, find the percentage change in *z* correct to 3 significant figures.

A. Increased by 55.5% B. Increased by 18.3%

C. Decreased by 30.9% D. Decreased by 3.40%

15. In the figure, the 1st pattern consists of 1 dot. For any positive integer *n*, the (*n* + 1)th pattern is formed by adding $2n+2$ dots to the *n*th pattern. Find the number of dots in the 8th pattern.



A. 89 B. 71 C. 63 D. 55

16. The axes of symmetries of the graphs of $y = 10(x-3)(x+7)$ and $y = 2x^2 - 3x + 6$ are $x = k_1$ and $x = k_2$ respectively. Which of the following is correct?

A. $0 < k_2 < k_1$ B. $k_2 < 0 < k_1$ C. $k_1 < k_2 < 0$ D. $k_1 < 0 < k_2$

17. If 6 identical solid metal cones of base radius *r* and height *h* are melted and recast into 2 identical spheres of radius *r*, *r* : *h* =

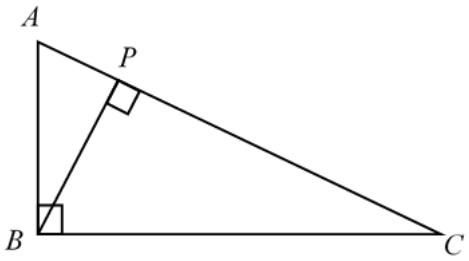
A. 3 : 1. B. 4: 3. C. 1 : 3. D. 3 : 4.

18. Convert $8^{16} + 177$ to a hexadecimal number.

A. $10000000000B1_{16}$ B. $1000000000B1_{16}$

C. $1000000000BE2_{16}$ C. $100000000BE2_{16}$

19. In the figure, ΔABC is a right-angled triangle with $\angle ABC = 90^\circ$. $AB = 5$, $BC = 12$ and $BP \perp AC$. Find $\frac{AP}{PC}$.



A. $\frac{5}{12}$ B. $\frac{5}{13}$

C. $\frac{25}{169}$ D. $\frac{25}{144}$

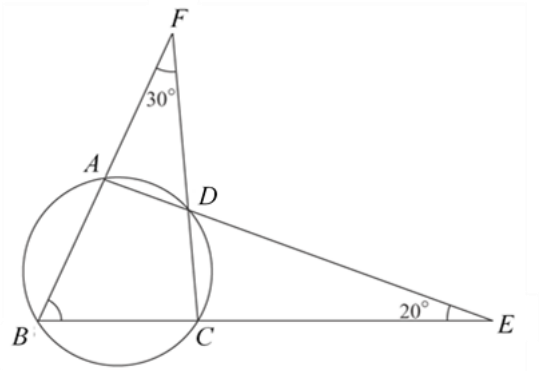
20. It is given that the polar coordinates of the points *A* and *B* are (*a* , 60º) and (5 , 180º) respectively. If $AB = \sqrt{39}$, *a* =

A. $\sqrt{14}$. B. 2. C. –7 or 2 . D. 7.

21. Find the number of roots of the equation $\tan x = 2\sin x$, where $0^\circ \le x < 360^\circ$.

A. 2 B. 3 C. 4 D. 5

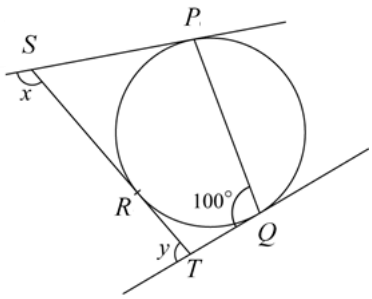
22. In the figure, *BA* and *CD* are produced to meet at *F*; *AD* and *BC* are produced to meet at *E*. If $\angle AFD = 30°$ and $\angle CED = 20°$, find $\angle ABC$.



A. 50° B. 60°

C. 65° D. 75°

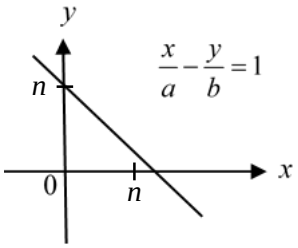
23. In the figure, *SP*, *TQ* and *ST* are tangents to the circle at *P*, *Q* and *R* respectively. If $\angle PQT = 100°$, find the value of $x + y$.



A. 150° B. 160°

C. 180° D. 200°

24. The figure shows the graph of $\frac{x}{a} - \frac{y}{b} = 1$. Which of the following is/are correct?



I. $a > 0$ II. $b > 0$ III. $b > -a$

A. I only B. I and III only

C. II and II only D. All of the above

25. Denote x_n as the general term of a geometric sequence. If $x_1 = 6$ and $x_5 = 96$, which of the following must be true?

I. $x_3^{\,2} = x_1 x_5$

II. All the terms in the sequence are positive.

III. x_1, x_4, x_7 is a geometric sequence.

A. I and II only B. I and III only C. II and III only D. All of the above

26. If the two straight lines $L_1 : ax - 7y + 11 = 0$ and $L_2 : 3x + 5y - b = 0$ have no point of intersection, which of the following is correct?

A. $a = \frac{21}{5},\ b \neq -\frac{55}{7}$ B. $a = \frac{21}{5},\ b = \frac{55}{7}$

C. $a = -\frac{21}{5},\ b \neq \frac{55}{7}$ D. $a = -\frac{21}{5},\ b = \frac{55}{7}$

27. If $\begin{cases} \log_2 y = x + 1 \\ 4(\log_4 y)^2 = 13 - 2x \end{cases}$, $y =$

A. 8. B. –6 or 2. C. $\frac{1}{2}$ or 128. D. $\frac{1}{32}$ or 8.

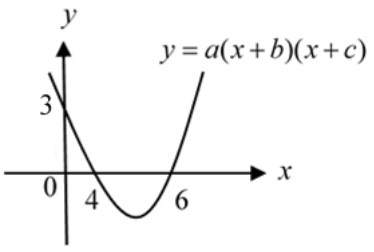
28. Solve $\log(a+4) = 2\log(a+2) - \log(a-1)$.

A. -8 B. 6 C. 8 D. No real solution

29. Let $f(x)$ be a polynomial. If $f(3x-4)$ is divisible by $x+1$, which of the following must be a factor of $f(2-x)$?

A. $x-9$ B. $x-7$ C. $x-5$ D. $x-3$

30. The figure shows the graph of $y = a(x+b)(x+c)$. The *x*-intercepts of the graph are 4 and 6, and the *y*-intercept is 3. If $b > c$, find the values of *a* and *b*.



A. $a = \frac{1}{8},\ b = 6$ B. $a = \frac{1}{8},\ b = -4$

C. $a = -\frac{1}{8},\ b = 6$ D. $a = \frac{1}{8},\ b = -6$

Section B

31. Simplify $(1+i)^{2018}$.

A. 2^{1009} B. -2^{1009} C. $2^{1009}i$ D. $-2^{1009}i$

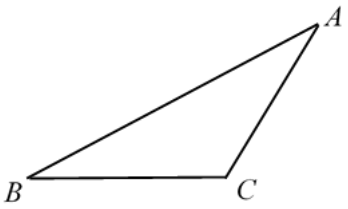
32. Mr. Chan deposits \$*P* in a bank at an interest rate of *r*% p.a. compounded quarterly. If the amount of money will be doubled after *t* months, *t* =

A. $\frac{3\log 2}{\log(1+0.25r\%)}$. B. $\frac{4\log 2}{\log(1+0.25r\%)}$. C. $\frac{12\log 2}{\log(4+r\%)}$. D. $\frac{\log 2}{4\log(1+r\%)}$.

33. The maximum value of $\frac{1}{4(\sin^2\theta-\sin\theta+1)}$ is

A. $\frac{1}{12}$. B. $\frac{1}{4}$. C. $\frac{4}{3}$. D. $\frac{1}{3}$.

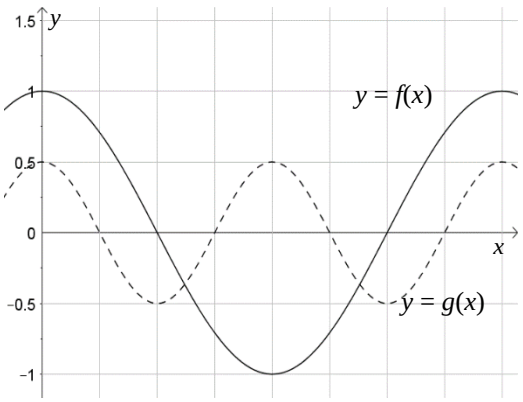
34. In the figure, $AC = BC$ and $AB = 6$. If the perimeter of ΔABC is $4\sqrt{3}+6$, find the area of ΔABC.



A. $\sqrt{3}$ B. $3\sqrt{2\sqrt{3}-3}$

C. $3\sqrt{3}$ D. $3(2\sqrt{3}+3)$

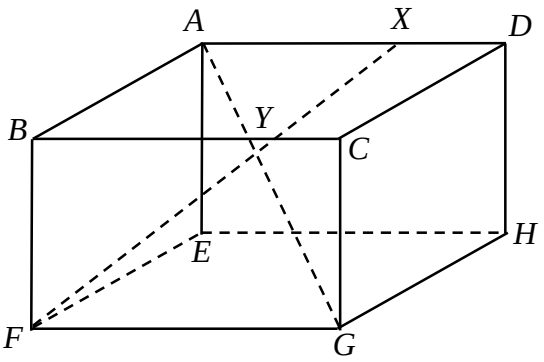
35. In the figure, the graph of the function $y = f(x) = \cos x$ is transformed to the graph of $y = g(x)$. Find $g(x)$.



A. $g(x)=\frac{1}{2}\sin 2x$ B. $g(x)=\frac{1}{2}\cos 2x$

C. $g(x)=\sin\frac{x}{2}-\frac{1}{2}$ D. $g(x)=\frac{1}{2}\cos\frac{x}{2}$

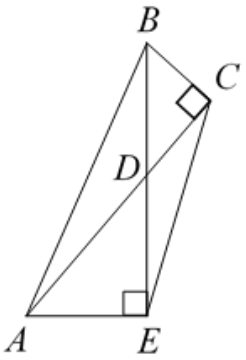
36. In the figure, *ABCDEFGH* is a cuboid and *ABFE* is a square. *X* lies on *AD* and *AG* intersects *XF* at *Y*. If $AX : XD : DH = 2 : 1 : 2$, find $\cos \angle FYG$.



A. $\frac{1}{\sqrt{51}}$ B. $\frac{2}{3}$

C. $\frac{3}{\sqrt{51}}$ D. $\frac{1}{9}$

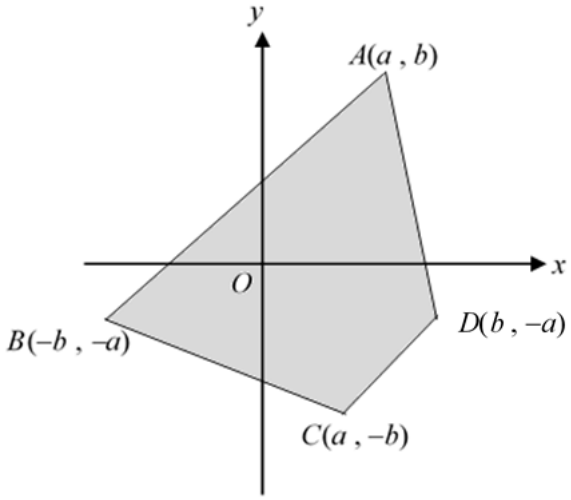
37. In the figure, *BE* and *CA* intersect at *D*. $\angle BCD = \angle AED = 90^\circ$, $BD : AD = 1 : 2$ and $BD : CD = 5 : 4$. If the area of ΔABD = 50 cm^2, find the area of the quadrilateral *AECB*.



A. 146 cm^2 B. 164 cm^2

C. 182 cm^2 D. 202 cm^2

38. In the figure, the vertices of the shaded region are $A(a, b)$, $B(-b, -a)$, $C(a, -b)$ and $D(b, -a)$ (where $a < b$). If (x, y) is a point lying in the shaded region (including the boundary) and $P = bx - ay$, which of the following must be correct?



I. $y = x - a - b$ is an equation of one of the boundaries of the region.

II. *P* attains its maximum at *B*.

III. The maximum value of *P* is $b^2 + a^2$.

A. II only B. III only

C. I and II only D. I and III only

39. Let k be a positive constant. Consider the circle $2x^2 + 2y^2 - 8x + ky - 10 = 0$ with radius 5 units. Which of the following is/are true?

I. $k = 16$

II. The origin lies inside the circle.

III. The centre of the circle is (2 , 4).

A. III only B. I and II only C. I and III only D. I, II and III

40. Let $a > 0$. The straight line $ax + \sqrt{2}y + 8 = 0$ intersects the circle $(x+1)^2 + y^2 = 9$ at $P(p , r)$ and $Q(q , s)$. If $pq = 8$, find a.

A. 2 B. 4 C. $\sqrt{8}$ D. Cannot be determined

41. Let $A(8, 8)$ and $B(14, 0)$ be two points on the rectangular coordinate plane and O be the origin. Find the y-coordinate of the orthocenter of ΔABO .

A. 3 B. 4 C. 5 D. 6

42. There are 8 boys and 6 girls in a class. Three representatives are selected from them. It is given that the girl named Anna in the class is selected. Find the probability that at least one boy is selected.

A. $\frac{34}{39}$ B. $\frac{14}{39}$ C. $\frac{72}{91}$ D. $\frac{17}{91}$

43. Mary and Peter each rolls a die once. The player who gets a bigger number wins. The game is tied if the players both get the same number. If Mary wins, she will receive \$10 from Peter. If she loses or the game is tied, she will give Peter \$8 or \$2 respectively. What is the expected gain of Mary in the game?

A. $-\$5\frac{1}{3}$ B. $-\$10$ C. \$0 D. \$0.5

44. The standard deviation of the five numbers of $4a-3$, $4a-1$, $4a+3$, $4a+7$, $4a+9$ is

A. $4a+3$. B. $4a+\frac{104}{5}$. C. $\sqrt{20.8}$. D. $2\sqrt{26}$.

45. Let m_1, r_1 and s_1 be the mean, the range and the standard deviation of a group of numbers $\{x_1, x_2, \cdots, x_n\}$ respectively. If m_2, r_2 and v_2 are the mean, the range and the variance of the group of numbers $\{2x_1 - 1, 2x_2 - 1, \cdots, 2x_n - 1\}$ respectively, which of the following must be true?

I. $m_2 = 2m_1 - 1$ II. $r_2 = 2r_1 - 1$ III. $v_2 = 4s_1$

A. I only B. II only C. I and III only D. I, II and III

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