Diocesan Girls' School
Secondary 6 Mock Examinations (2019-2020)
Mathematics (Compulsory Part)
Paper 2

Feb 2019

Time Allowed: 1 hour 15 minutes Total marks: 45

Name:_____( ) Class:_____ Set:_____

Instructions:

1. All questions carry equal marks.
2. ANSWER 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 MARKS for that question.
4. No marks will be deducted for wrong answers.
5. The 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. $a^2 - b^2 - 2a + 2b =$

A. $(a+b)(a-b+2)$. B. $(a+b)(a-b-2)$.
C. $(a-b)(a+b+2)$. D. $(a-b)(a+b-2)$.

2. $\dfrac{8^{333}}{(2x^2)^{-3}} =$

A. $4^{501}x^6$. B. $4^{336}x^6$. C. $4^{111}x^6$. D. $4^{336}x^5$.

3. $4a = \dfrac{2c-3ab}{5}$, $a =$

A. $\dfrac{2c}{3b+20}$. B. $\dfrac{2c}{3b-20}$. C. $\dfrac{2c}{15b+20}$. D. $\dfrac{10c}{15b+4}$.

4. $\sqrt{2\pi} =$

A. 2.50 (correct to 3 significant figures).

B. 2.5066 (correct to 4 significant figures).

C. 2.50662 (correct to 5 decimal places).

D. 2.507 (correct to 3 decimal places).

5. The solution of $2-2x \geq \frac{4-x}{3}$ or $\frac{x}{2}+\frac{1}{3}<\frac{1}{6}$ is

A. $-\frac{1}{3}<x\leq\frac{2}{5}$. B. $x\leq\frac{2}{5}$. C. $x<-\frac{1}{3}$. D. $x<-\frac{1}{3}$ or $x\geq\frac{2}{5}$.

6. Let k be a constant. If $f(x+k)=x^2-k^2$, $f(x)=$

A. x^2-2kx. B. $(x-k)^2$. C. $x^2-2kx-2k^2$. D. $(x-k)(x+k)$.

7. Let n be a positive integer. Find the value of k if $x^{2n}+kx-2k$ is divisible by $x+1$.

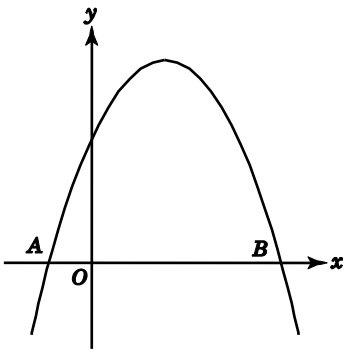
A. 1 B. -3 C. -1 D. $\frac{1}{3}$

8. If m and n are constants such that $2mx(x+1)+\frac{x^2}{2}\equiv nx(x-4)+7x$, find the values of m and n.

A. $m=\frac{1}{2}$ and $n=\frac{3}{2}$ B. $m=\frac{1}{2}$ and $n=\frac{5}{2}$

C. $m=1$ and $n=\frac{3}{2}$ D. $m=1$ and $n=\frac{5}{2}$

9. In the figure, the graph of a quadratic function cuts the x-axis at two points $A(-1,0)$ and $B(3,0)$. The y-intercept of the graph is 6. $C(p,q)$ lies on the graph and $-1<p<3$. Find the maximum possible area of ΔABC.



A. 32 B. 16

C. 12 D. 8

10. A sum of $7000 is deposited at an interest rate of 9% per annum for 1 year, compounded quarterly. Find the interest correct to the nearest dollar.

A. $630 B. $652 C. $656 D. $657

11. Let u and v be non-zero constants. If $(2u+4v):(5u-2v)=2:3$, $u:v=$

A. 1 : 4. B. 4 : 1. C. 11 : 14. D. 14 : 11.

12. If z varies directly as x and inversely as the square root of y, which of the following must be true?

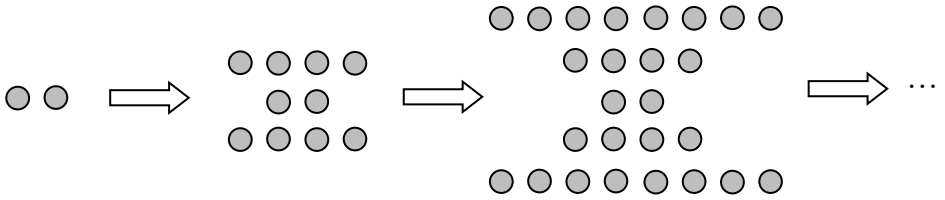
I. $z=\dfrac{x}{\sqrt{y}}$.

II. $\dfrac{yz^2}{x^2}$ is a constant.

III. z decreases by 50% when y increases to 4 times of its original and x remains unchanged.

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

13. In the figure, the first pattern consists of 2 dots. For any positive integer n, the $(n+1)$th pattern is formed by adding 2^{n+2} dots to the nth pattern. Find the number of dots in the 8th pattern.

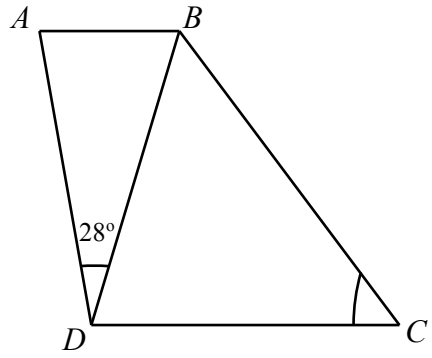


A. 506 B. 508 C. 1018 D. 1020

14. The radii of a sphere and the base of a right circular cone are both equal to r. If the surface area of the sphere equals the curved surface area of the cone, find the volume of the cone in terms of r.

A. $\dfrac{\sqrt{15}}{3}\pi r^3$ B. $\dfrac{4}{3}\pi r^3$ C. $\dfrac{\sqrt{17}}{3}\pi r^3$ D. $5\pi r^3$

15. In the figure, $AB \parallel DC$, $AD = BD = CD$ and $\angle ADB = 28^\circ$.

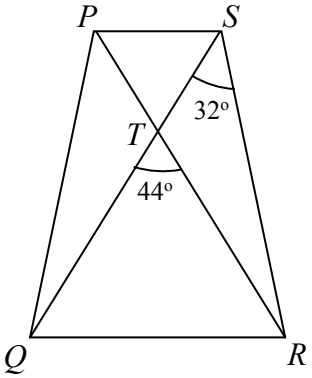


Find $\angle BCD$.

A. 36° B. 48°

C. 52° D. 76°

16. In the figure, $PQRS$ is a quadrilateral. PR intersects SQ at T. $TP = TS$ and $TQ = TR$. $\angle QSR = 32^\circ$ and $\angle QTR = 44^\circ$.



Which of the following is/are true?

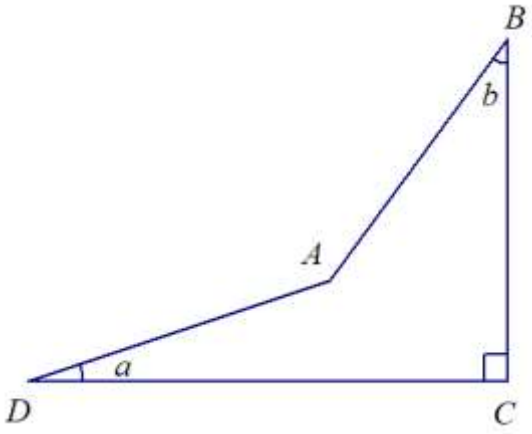
I. $PS \parallel QR$

II. $\angle SRQ = 78^\circ$

III. $PQ = SR$

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

17. In the figure, $BC =$



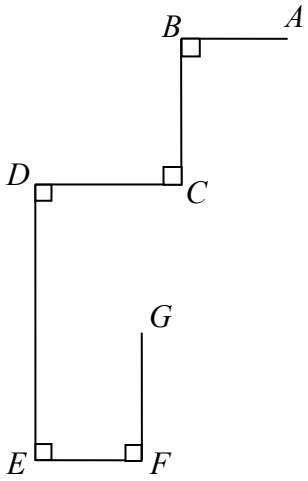
A. $AB\sin a + AD\cos b$.

B. $AD\sin b + AB\cos a$.

C. $AB\sin b + AD\cos a$.

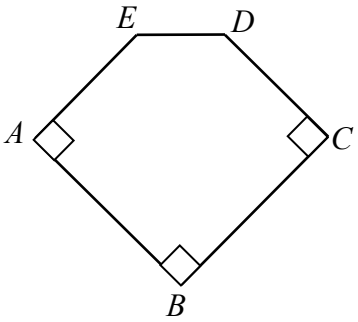
D. $AD\sin a + AB\cos b$.

18. In the figure, $AB = EF = 1$ cm, $BC = CD = \frac{1}{2}DE = 2$ cm and $FG = x$ cm. If $AG = \frac{2\sqrt{194}}{5}$ cm, $x =$



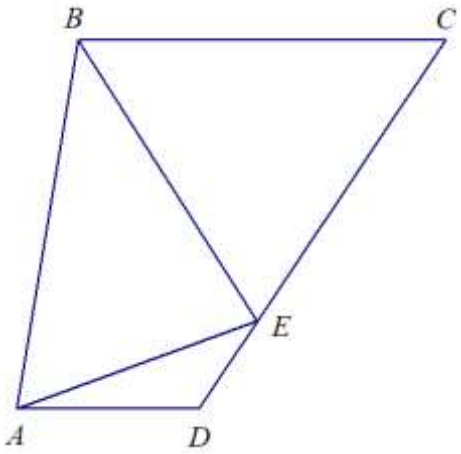
A. 2.
B. 1.5.
C. 1.
D. 0.8.

19. In the figure, $ABCDE$ is a pentagon with $\angle A = \angle B = \angle C = 90^\circ$, $AB = BC = 12$ cm, $DE = 4\sqrt{2}$ cm and $AE = CD$. Find the area of the pentagon $ABCDE$.



A. 136 cm^2
B. 144 cm^2
C. 168 cm^2
D. 180 cm^2

20. In the figure, $ABCD$ is a trapezium with $AD // BC$ and $BC : AD = 2:1$. E is a point lying on CD such that $CE : ED = 3:1$. If the area of ΔABE is 10 cm^2, find the area of the trapezium $ABCD$.

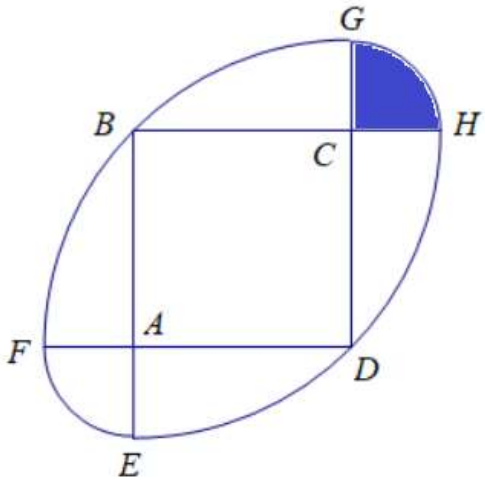


A. 20 cm^2
B. 22.5 cm^2
C. 24 cm^2
D. 25.5 cm^2

21. Simplify $\frac{4}{x^2-x-12}+\frac{x}{x+3}$.

A. $\frac{x-1}{(x+3)(x-4)}$ B. $\frac{(x-1)^2}{(x+3)(x-4)}$ C. $\frac{(x-2)^2}{(x+3)(x-4)}$ D. $\frac{x-2}{(x+3)(x-4)}$

22. In the figure, $ABCD$ is a square with side 10 cm. EF, FBG, GH and HDE are four arcs centred at A, D, C and B respectively such that FAD, EAB, HCB and GCD are straight lines. Find the area of the shaded region bounded by GC, CH and GH correct to the nearest cm^2.

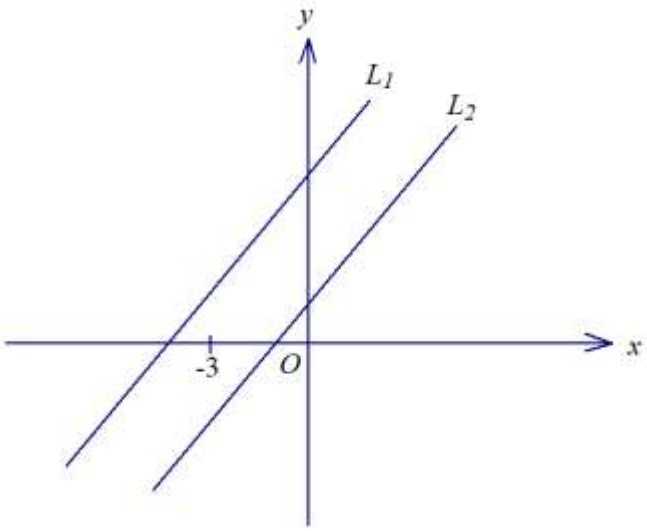


A. 2 cm^2 B. 6 cm^2

C. 13 cm^2 D. 54 cm^2

23. In the figure, the equations of the parallel straight lines L_1 and L_2 are $ax+2y+b=0$ and $px+y+q=0$ respectively. Which of the following is/are true?

I. $a<0$
II. $b>2q$
III. $b<6p$



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

24. The straight line L is perpendicular to the straight line $2x+y-4=0$. If the y-intercept of L is 4, the equation of L is

A. $3x-6y+4=0$. B. $x-2y-4=0$. C. $3x-6y-4=0$. D. $x-2y+8=0$.

25. The polar coordinates of the points P, Q and R are (4 , 75°), (q , 165°) and (8 , 255°) respectively. If the area of ΔPQR is 18, q =

A. 1.5. B. 3. C. 4. D. 4.5.

26. The equations of the circles C_1 and C_2 are $x^2+y^2+4x-12y-40=0$ and $x^2+y^2-4x-8y=0$ respectively. Let G_1 and G_2 be the centres of C_1 and C_2 respectively. Denote the origin by O. Which of the following are true?

I. $OG_2 \perp G_1G_2$

II. C_1 and C_2 touch each other internally.

III. The area of C_1 is 4 times that of C_2.

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

27. It is given that A and B are two distinct points lying on the circle $x^2+y^2-4x-2y+1=0$. The mid-point of AB is (2 , 0). Let P be a moving point in the rectangular coordinate plane such that $AP^2+BP^2=AB^2$. The equation of the locus of P is

A. $x^2+y^2-4x+1=0$.

B. $(x-2)^2+y^2=4$.

C. $x=2$.

D. $y=x^2-2x+4$.

28. The table below recorded the admission scores of candidates applying for a programme in a university.

Admission Scores	22	23	24	25	26
Number of Candidates	23	22	n	82	65

If the expected admission score of the programme is 24.6, n =

A. 44. B. 46. C. 48. D. 50.

29. Daniel has 8 pens and only 1 of them is a black ball pen. He selects the pens one by one at random without replacement. Find the probability that he selects the black ball pen in more than 2 trials.

A. $\frac{1}{4}$ B. $\frac{3}{4}$ C. $\frac{1}{8}$ D. $\frac{5}{8}$

30. Consider the following numbers:

$$25 \quad 32 \quad 32 \quad 50 \quad 58 \quad 63 \quad 78 \quad i \quad j \quad k$$

The mean and the mode of the above data are 51 and 58 respectively. Find the median.

A. 50. B. 54 C. 56 D. 57

Section B

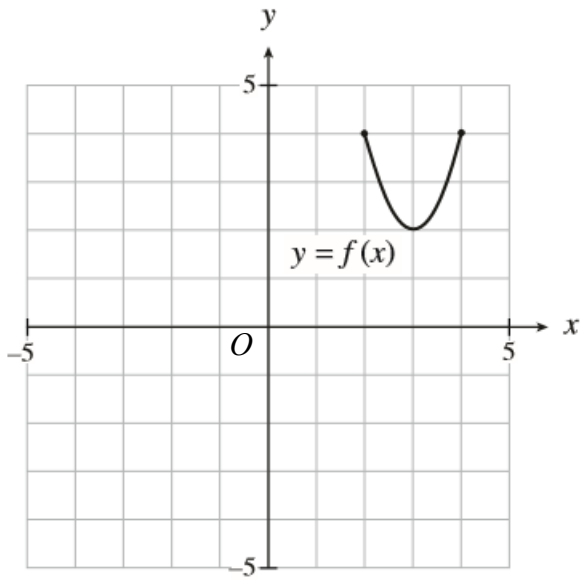
31. The real part of $\dfrac{6i^6+7i^7+8i^8+9i^9+10i^{10}}{1+i}$ is

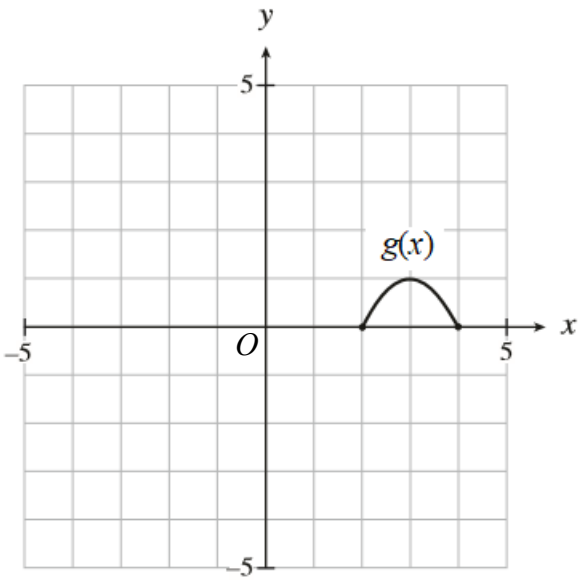
A. -5. B. -3. C. 3. D. 5.

32. $8^5+8^{11}=$

A. 20000800_{16}. B. 200002000_{16}. C. 200008000_{16}. D. 100000100000_{16}.

33. The graphs of $y=f(x)$ and $y=g(x)$ are shown below. Express $g(x)$ in terms of $f(x)$.

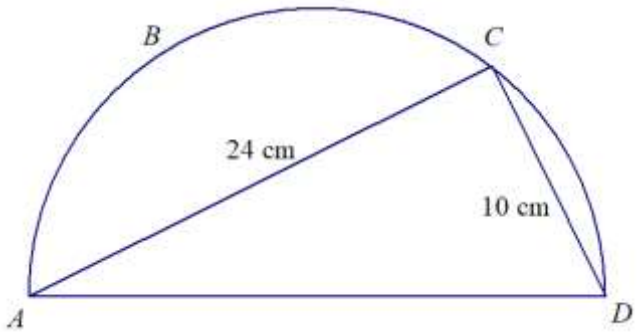




A. $g(x)=-2f(x)+2$ B. $g(x)=-2f(x)+3$

C. $g(x)=-\dfrac{1}{2}f(x)+3$ D. $g(x)=-\dfrac{1}{2}f(x)+2$

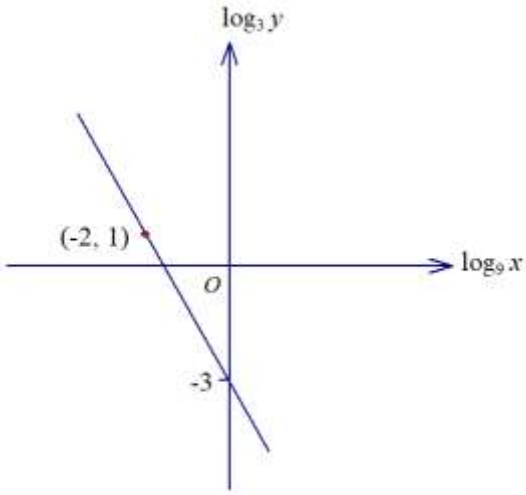
34. In the figure, $ABCD$ is a semicircle. It is given that $AC = 24$ cm and $CD = 10$ cm. Find the area of the segment ABC correct to the nearest cm^2.



A. 79 cm^2 B. 139 cm^2

C. 145 cm^2 D. 199 cm^2

35. The graph in the figure shows the linear relation between $\log_9 x$ and $\log_3 y$. Which of the following must be true?



A. $x + y = -3$ B. $x + y = -27$

C. $x + y = \frac{1}{27}$ D. $xy = \frac{1}{27}$

36. Let a_n be the nth term of a geometric sequence. It is given that $a_4 = \frac{1}{12}$ and $a_8 = \frac{4}{243}$. If the sum to infinity of the sequence is smaller than $\frac{1}{2}$, which of the following is/are true?

I. The first term of the sequence is $\frac{9}{32}$.

II. $a_1 + a_2 + a_3 + a_4 + \cdots + a_9 + a_{10} < -\frac{1}{10}$

III. $a_2 + a_4 + a_6 + a_8 + \cdots = \frac{27}{80}$

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

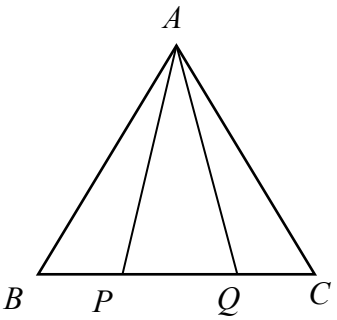
37. Consider the following system of inequalities:

$$\begin{cases} 2x - y \le 0 \\ 4x - y \ge 0 \\ 4x + y \le 24 \end{cases}$$

Let R be the region which represents the solution of the above system of inequalities. If (x, y) is a point lying in R, the greatest value of $y - 3x + 10$ is

A. 6. B. 10. C. 13. D. 18.

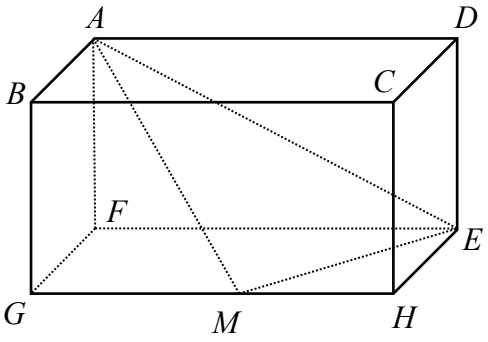
38. In the figure, ΔABC is an equilateral triangle with P and Q lying on BC. If $BP = PQ = QC$, find $\angle PAQ$ correct to the nearest degree.



A. 22° B. 21°

C. 20° D. 19°

39. In the figure, $ABCDEFGH$ is a rectangular block. M is the midpoint of GH. AD = 24 cm, EH = 12 cm and DE = 10 cm. Find the angle between the planes AME and $EFGH$.

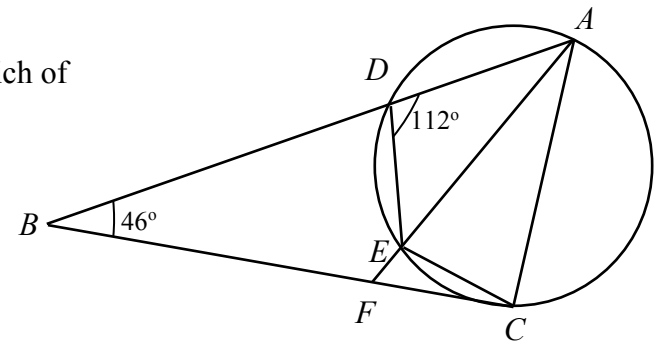


A. 31° B. 45°

C. 50° D. 69°

40. In the figure, BFC is the tangent to the circle at C. AB and AF cut the circle at D and E respectively.

$\angle ADE = 112^\circ$, $\angle ABC = 46^\circ$ and $\overset{\frown}{DE} = \overset{\frown}{EC}$. Which of the following is/are true?



I. $\Delta DAE \sim \Delta FAB$.

II. AC is the diameter of the circle.

III. B, D, E and F are concyclic.

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

41. A circle is inscribed in ΔABC. The coordinates of A, B and C are (0 , 10), (0 , −14) and (18 , −14) respectively. Find the coordinates of the centre of the circle.

A. (6 , −8) B. (8 , −4) C. (6 , −6) D. (4 , −8)

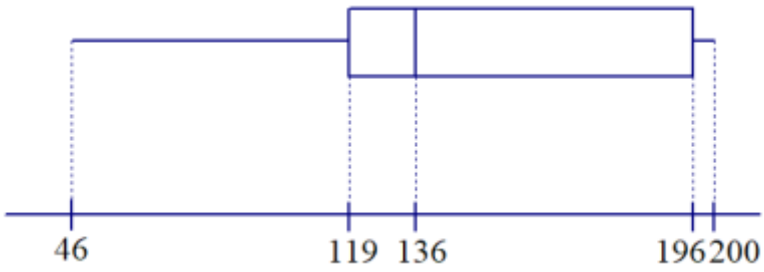
42. There are 12 cats and 18 dogs in a pet shop. 6 pets are selected from the pet shop. In how many different ways can the pets be selected if the number of dogs is not less than that of cats?

A. 502 860 B. 484 296 C. 457 419 D. 323 340

43. When Alice throws a dart, the probability that she hits the target is 0.8. If Alice throws the dart 5 times, find the probability that she hits the target at most 4 times.

A. 0.10784 B. 0.32768 C. 0.67232 D. 0.89216

44. The box-and-whisker diagram below shows the distribution of the scores of some students in an English test. The standard deviation is 62 marks and the mean is higher than 119 marks but lower than 136 marks. Given that Alice's score is above the third quartile, which of the following may be her standard score?



A. 0.9 B. 1.3 C. 1.4 D. 1.5

45. The variance of the 4 numbers $\{x_1, x_2, x_3, x_4\}$ is 7.5 and the variance of the 5 numbers $\{y_1, y_2, y_3, y_4, y_5\}$ is 4.2. It is given that the mean of the two sets of numbers are the same. Find the standard deviation of the 9 numbers $\{x_1, x_2, x_3, x_4, y_1, y_2, y_3, y_4, y_5\}$ correct to 3 significant figures.

A. 2.67 B. 2.38 C. 5.38 D. 5.67

END OF PAPER