2020-DSE
MATH CP
PAPER 2

MC

P.O.C.A. WONG SIU CHING SECONDARY SCHOOL

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2020

MATHEMATICS Compulsory Part
PAPER 2

11:15 am – 12.30 pm (1¼ hours)

INSTRUCTIONS

1. Read carefully the instruction on the Answer Sheet. After the announcement of the start of the examination, you should first insert the information required in the space provided.

2. When told to open this book, you should check that all the questions are there. Look for the words '**END OF PAPER**' after the last question.

3. All questions carry equal marks.

4. **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 answer clearly; otherwise you will lose marks if the answers cannot be captured

5. You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.

6. No marks will be deducted for wrong answers.

Not to be taken away before the end of the examination session

There are 30 questions in Section A and 15 questions in Section B.
The diagram in this paper are not necessarily drawn to scale.
Choose the best answer for each question.

Section A

1. $m^2 - 4n^2 - 6m + 9 =$

   A. $(m - 2n - 3)(m + 2n - 3)$.

   B. $(m - 2n - 3)(m + 2n + 3)$.

   C. $(m - 2n + 3)(m + 2n - 3)$.

   D. $(m + 2n - 3)^2$.

2. $\left(\frac{1}{3}\right)^{2020} (-3)^{2019} =$

   A. -3.

   B. $-\frac{1}{3}$.

   C. $-\frac{1}{3^{4039}}$.

   D. $\frac{1}{3}$.

3. If $\frac{b-c}{b+c} = a$, then $c =$

   A. $\frac{b(1+a)}{2}$.

   B. $\frac{b(1-a)}{1+a}$.

   C. $\frac{b(1+a)}{1-a}$.

   D. $\frac{2b}{1+a}$.

4. $0.095274986 =$

A. 0.09 (correct to 2 significant figures).

B. 0.095 (correct to 2 decimal places).

C. 0.095274 (correct to 6 decimal places).

D. 0.09527 (correct to 4 significant figures).

5. The solution of $18x-3<12x+12\le 20x+8$ is

A. $x\ge -\frac{11}{2}$.

B. $x<\frac{5}{2}$.

C. $-\frac{11}{2}\le x<\frac{5}{2}$.

D. $\frac{1}{2}\le x<\frac{5}{2}$.

6. Let m be a constant. If $f(x)=3x^2+x-m$, then $f(m)-f(-m)=$

A. $2m$.

B. $-2m$.

C. 0.

D. $6m^2+2m$.

7. When $f(x)$ is divided by x^2-x-6, the remainder is $-3x+4$. Find the remainder when $f(x)$ is divided by $x+2$.

A. -5

B. -2

C. 10

D. 13

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8. If p and q are constants such that $x^2 + p \equiv (x+3)(x+q)+10$, then $p =$

A. 10.

B. 1.

C. -3.

D. -9.

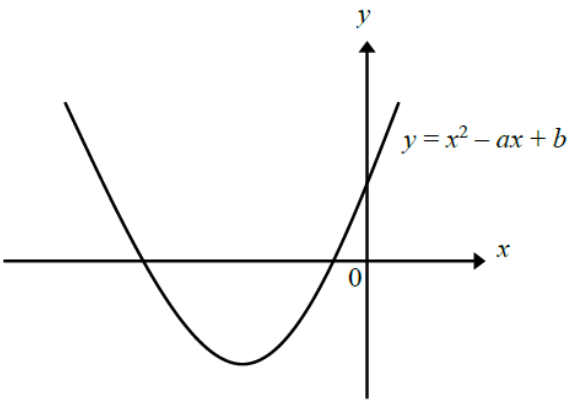
9. The figure shows the graph of $y = x^2 - ax + b$, where a and b are constants. Which of the following is true?

A. $a < 0$ and $b > 0$

B. $a < 0$ and $b < 0$

C. $a > 0$ and $b > 0$

D. $a > 0$ and $b < 0$



10. The base radius of a right circular cylinder is increased by 30% and the height is decreased by 30%. What is the percentage change in its volume?

A. Increased by 18.3%

B. Increased by 6%

C. Decreased by 9%

D. The volume remains unchanged

11. June cycles for 6 minutes from her home to a town at a constant speed of 24 km/h. If the distance between her home and the town is 8 cm on a map, find the scale of the map.

A. $1:60000$

B. $1:30000$

C. $1:15000$

D. $1:300$

12. It is given that p varies directly as square root of q and inversely as s^2. Which of the following must be a constant.

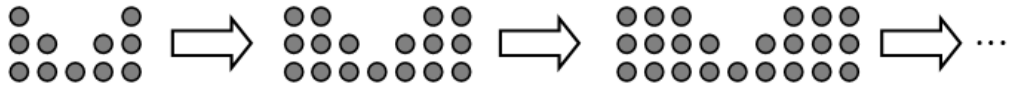
A. $\frac{p^2}{qs^4}$

B. $\frac{s^4}{p^2q}$

C. $\frac{1}{p^2qs^4}$

D. $\frac{q}{p^2s^4}$

13. In the figure, the 1st pattern consists of 11 dots. For any positive integer n, the $(n+1)$ th pattern is formed by adding 6 dots to the n th pattern. Find the number of dots in the 8 th pattern.



A. 35

B. 41

C. 47

D. 53

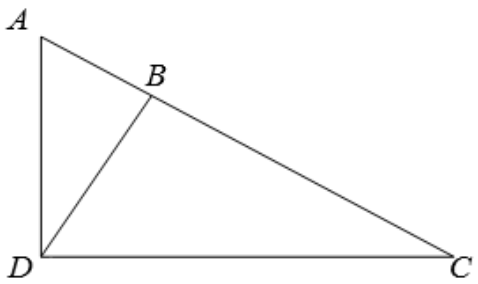
14. In the figure, ABC is a straight line. $AB = 12$ cm, $AD = 37$ cm, $BD = 35$ cm and $CD = 125$ cm. Find the perimeter of ΔBDC.

A. 120 cm.

B. 238 cm.

C. 240 cm

D. 280 cm.



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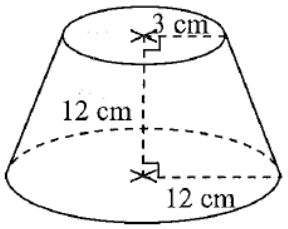
15. The figure shows a frustum of a right circular cone. The radii of the upper base and the lower base are 3 cm and 12 cm respectively. The height of the frustum is 12 cm . Find the total surface area of the frustum.

A. 225π cm^2

B. 333π cm^2

C. 378π cm^2

D. 393π cm^2



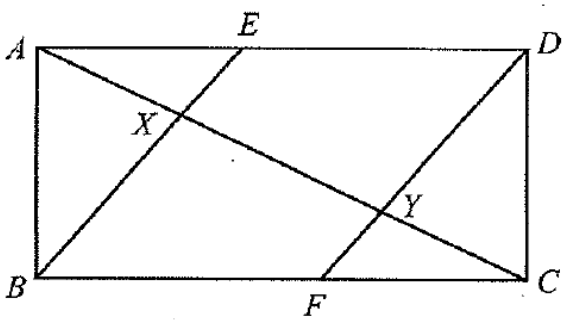
16. In the figure, $ABCD$ is a rectangle. E and F are points on AD and BC respectively such that $AE : DE = CF : BF = 2 : 3$ and AC cuts BE and DF at the points X and Y respectively. If the area of ΔAEX is 16 cm^2, then the area of the quadrilateral $BFYX$ is

A. 24 cm^2.

B. 36 cm^2.

C. 84 cm^2.

D. 100 cm^2.



17. In the figure, ΔABC is an isosceles triangle and $AB = BC = CF$. It is known that $\angle ADE = \angle ECF$, $\angle BFD = 15°$, Which of the following must be true?

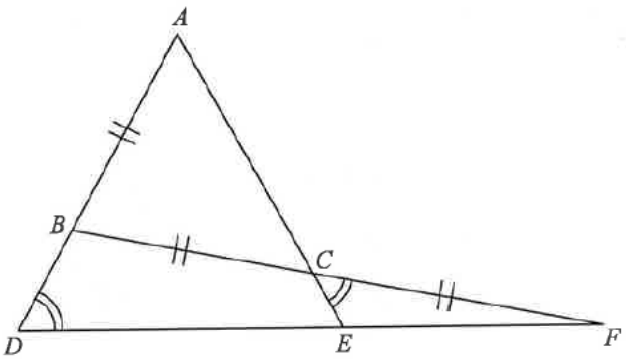
I. ΔADE is an isosceles triangle
II. $\angle BDF = 55°$
III. $BD = 2CE$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III



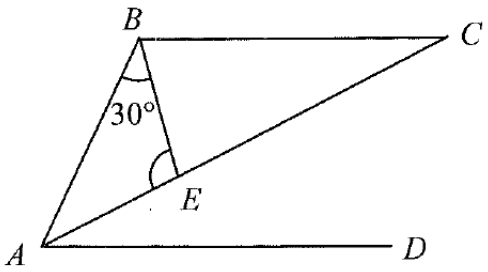
18. In the figure, $AD // BC$, AC is the angle bisector of $\angle BAD$. E is a point lying on AC such that $BC = CE$. If $\angle ABE = 30°$, find $\angle AEB$.

A. 102°

B. 110°

C. 120°

D. 126°



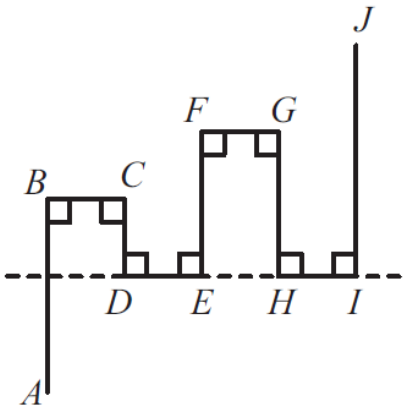
19. In the figure, $BC = CD = DE = FG = HI = 2$ cm, $BA = 5$ cm and $JI = 6$ cm. Find the distance between A and J correct to 3 significant figures.

A. 11.8 cm

B. 12.0 cm

C. 12.3 cm

D. 13.1 cm



20. $ABCD$ is a parallelogram. The diagonal BD is an axis of symmetry of $ABCD$ and $AC = BD$. AC and BD meet at E. If M is the mid-point of AB and N is the mid-point of CD, which of the following are true?

I. $AB = BC = CD = AD$

II. $AC \perp BD$

III. $\Delta BEM \cong \Delta CEN$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

Go on to the next page

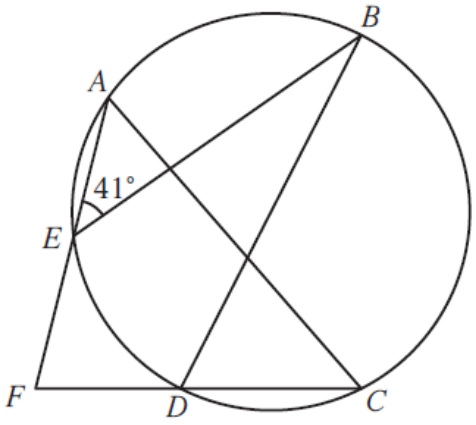
21. In the figure, DB is a diameter of the circle $ABCDE$. F is a point outside the circle such that FEA and FDC are straight lines. If $FA = FC$ and $\angle AEB = 41°$, then $\angle AFC =$

A. $74°$.

B. $82°$.

C. $90°$.

D. $98°$.



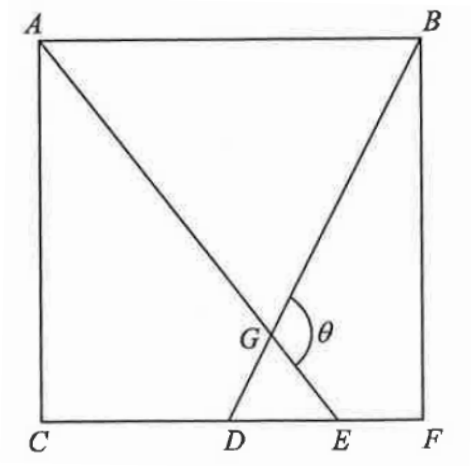
22. In the figure, $ABFC$ is a square and $CD : DE : EF = 2 : 1 : 1$. Find the value of θ correct to 3 significant figures.

A. $105°$

B. $110°$

C. $117°$

D. $121°$



23. In the figure, the equations of the straight lines L_1 and L_2 are $x + ay + b = 0$ and $x + cy + d = 0$ respectively. Which of the following are true?

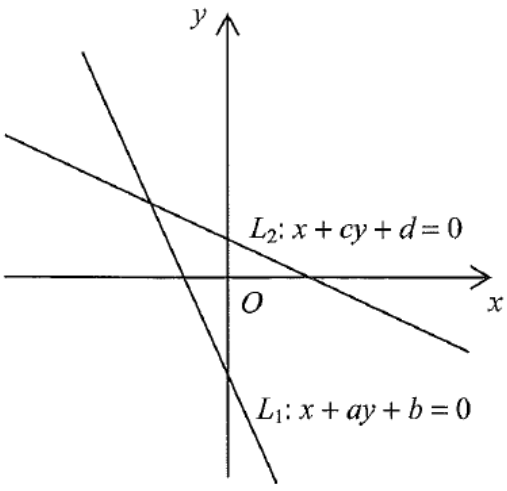
I. $b > d$
II. $a < c$
III. $ab < cd$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III



24. The straight lines $L_1 : 7x - y - 6 = 0$ and $L_2 : x - 4y + 12 = 0$ intersect at T. Given that $A(2 , a)$ and $B(c , d)$ lie on L_1 and L_2 respectively such that AB is perpendicular to L_2. Find the length of AB correct to 2 decimal places.

A. 1.78

B. 3.68

C. 4.37

D. 4.67

25. The polar coordinates and the rectangular coordinates of a point P are $(r , 150°)$ and $(x , 1)$ respectively. Find the value of x.

A. -2

B. $-\sqrt{3}$

C. $\sqrt{3}$

D. 2

26. The equation of a circle C is $2x^2 + 2y^2 - 12x + 44y - 317 = 0$. Which of the following are true?

I. The coordinates of centre of C is $(3 , -11)$.
II. The radius of C is shorter than 28.
III. The line segment joining the origin and the centre of C has a perpendicular bisector which has a positive $x-$intercept.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

27. The coordinates of point A are $(0 , 4)$. Let P be a moving point in the rectangular coordinate plane such that its distance from A is always the same as that from the $x-$axis. Denote the locus of P by Γ. The equation of the axis of symmetry of Γ is

A. $x = 0$.

B. $y = 0$.

C. $x = 2$.

D. $y = 2$.

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28. In a game, a box contains n silver coins and 20 bronze coins. A coin is randomly drawn from the box. If a silver coin is drawn, \$70 will be gained; otherwise, \$42 will be gained. Find the value of n if the expected value of the game is \$62 .

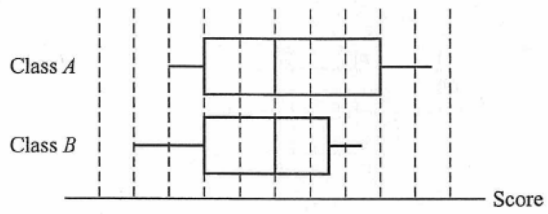
A. 16

B. 28

C. 50

D. 60

29. The box-and-whisker diagram below shows the distribution of the scores in a test for classes A and B respectively.



Which of the following statements must be true?

I. The top 25% students in class A perform better than those in class B .
II. The medians of the scores for both classes are the same.
III. The range of the scores for class A is smaller than the range of the scores for class B .

A. II only

B. III only

C. I and II only

D. I and III only

30. The stem-and-leaf diagram below shows the distribution of the numbers of cakes sold in a bakery on some days.

Stem (10)	*Leaf (1)*
1	x 8 9 9 9
2	x x 7 7 8 8 9 9
3	0 1 2 2 3 y y
4	0 2 3 y

If the inter-quartile range of the distribution is greater than 14 , which of the following is/are true?

I. $3 \le x \le 7$
II. $6 \le y \le 9$
III. The range of the distribution is at most 39

A. I only

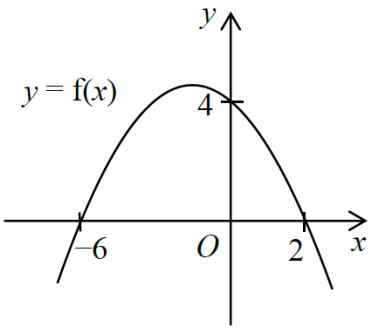
B. II only

C. I and III only

D. II and III only

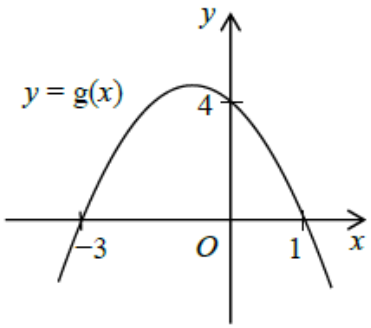
Section B

31.

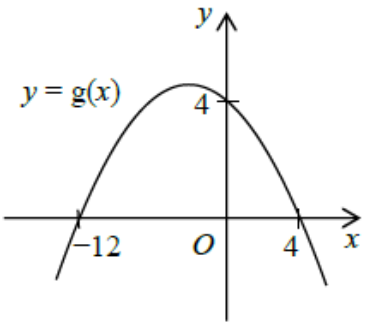


The figure above shows the graph of $y = f(x)$. If $f(2x) = g(x)$, which of the following may represent the graph of $y = g(x)$.

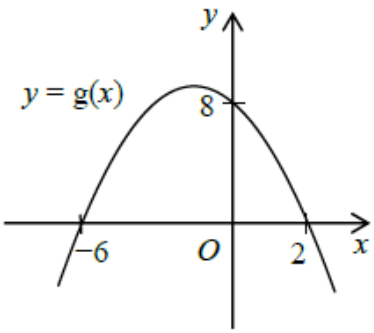
A.



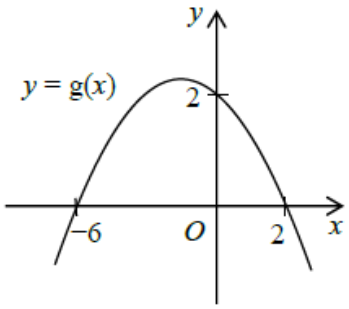
B.



C.



D.



32. $5\times 2^8 + 17 - 48\times 2^3 =$

A. 110001001_2.

B. 111001001_2.

C. 1100010001_2.

D. 1110010001_2.

Go on to the next page

33. If $\alpha \neq \beta$ and $\alpha^2 + 4\alpha = \beta^2 + 4\beta = 3$, then $\left(\frac{2}{2^\alpha}\right)^{1-\beta} =$

A. $\frac{1}{64}$.

B. 1.

C. 4.

D. 256.

34. Which of the following is the least?

A. 2019^{-2910}

B. 2190^{-2109}

C. 2109^{-2190}

D. 2910^{-2019}

35. $\frac{2(1-2i)i^{10}}{1+i} =$

A. $1-3i$.

B. $1+3i$.

C. $3-i$.

D. $-3+i$.

36. The sum to infinity of a geometric sequence is 24 and the sum to infinity of the squares of the terms of the same sequence is 192. Find the second term of the sequence.

A. $\frac{1}{2}$

B. 4

C. 6

D. 12

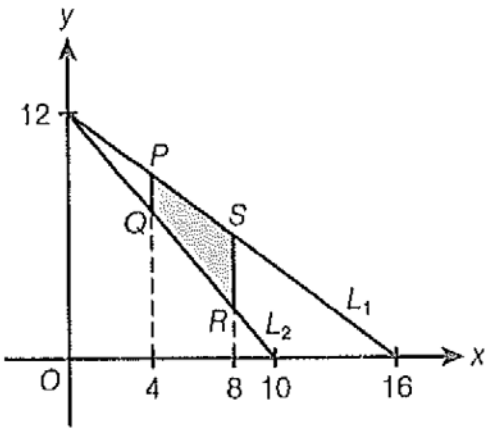
37. In the figure, P and S are points lying on the straight line L_1, while Q and R are points lying on the straight line L_2. PQ and SR are parallel to the $y-$axis. If (x, y) is a point lying in the shaded region $PQRS$ (including the boundary), at which point does $3x-y-5$ attain its greatest value?

A. P

B. Q

C. R

D. S



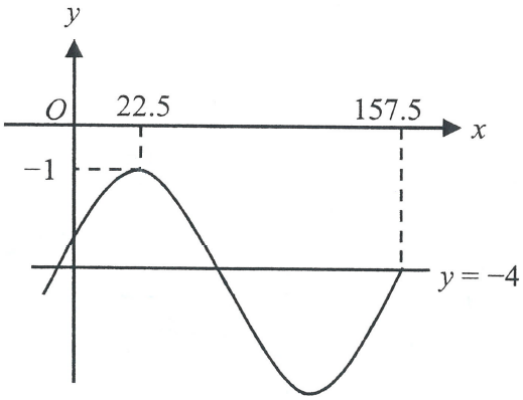
38. Let k be a positive constant and $-90° < \theta < 90°$. If the figure shows the graph of $y = -4 + 3\sin(kx° + \theta)$, then

A. $k = \frac{1}{2}$ and $\theta = -45°$.

B. $k = \frac{1}{2}$ and $\theta = 45°$.

C. $k = 2$ and $\theta = -45°$.

D. $k = 2$ and $\theta = 45°$.



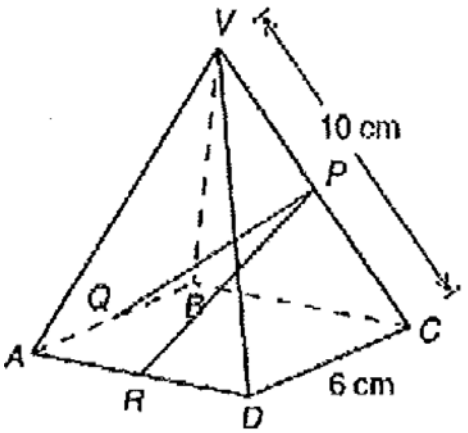
39. In the figure, $VABCD$ is a right pyramid with a square base of side 6 cm. The slant edge of the pyramid is 10 cm. P, Q and R are the mid-points of VC, AB and AD respectively. Find the value of $\cos\angle QPR$.

A. $\frac{11}{200}$

B. $\frac{34}{43}$

C. $\frac{\sqrt{6622}}{86}$

D. $\frac{6\sqrt{77}}{77}$



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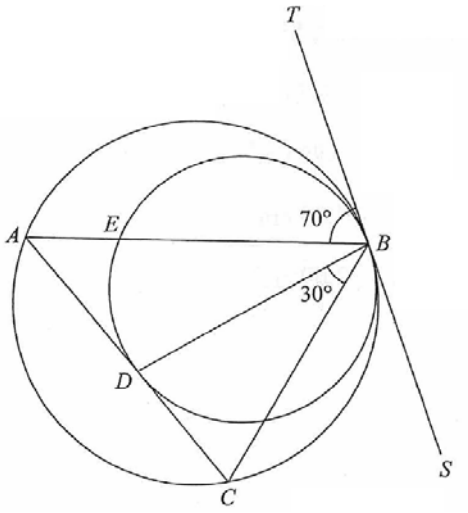
40. In the figure, SBT is the common tangent to the two circles ABC and BDE at B. ADC is the tangent to the circle BDE at D and AB intersects the circle BDE at E. If $\angle ABT = 70°$ and $\angle CBD = 30°$, find $\angle ABD$.



A. $10°$

B. $20°$

C. $30°$

D. $40°$

41. Let a be a constant. The straight line $L_1 : x - 3y - a = 0$ and $L_2 : 4x + 3y + a = 0$ cuts the $x-$axis at P and Q respectively. It is given that L_1 and L_2 intersect at R. If the coordinates of the orthocentre of ΔPQR is $(0\ ,\ 18)$, then $a =$

A. -24.

B. $-\frac{27}{2}$.

C. $\frac{27}{2}$.

D. 24.

42. There are 9 male members and 6 female members in a club. 4 members are randomly selected from them to form a committee. Find the number of combinations that the committee consists of members of both sex.

A. 141

B. 1224

C. 1239

D. 1363

43. A bag contains 4 gold coins and 3 silver coins. Paul repeats drawing a coin at a time randomly from the bag without replacement until a gold coin is drawn. Find the probability that he needs at least three draws.

A. $\frac{24}{343}$

B. $\frac{1}{35}$

C. $\frac{4}{35}$

D. $\frac{1}{7}$

44. In test 1, Tom gets 80 marks and his standard score is 2. The mean and the standard deviation of test 2 remains unchanged and decreased by 20% respectively. If Tom gets 80 marks again in his test 2, then his standard score in test 2 is

A. 1.6.

B. 2.

C. 2.4.

D. 2.5

45. Let m_1, r_1 and v_1 be the mean, the range and the variance of a group of numbers $\{x_1, x_2, x_3, ..., x_{50}\}$ respectively. If m_2, r_2 and v_2 be the mean, the range and the variance of a group of numbers $\{2-x_1, 2-x_2, 2-x_3, ..., 2-x_{50}, 2-m_1\}$ respectively. Which of the following must be true?

I. $m_2 = 2 - m_1$

II. $r_2 = r_1$

III. $v_2 = v_1$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

END OF PAPER