

science  
& technology

Department:  
Science and Technology  
REPUBLIC OF SOUTH AFRICA

## SOUTHERN AFRICAN JUNIOR MATHEMATICS OLYMPIAD

FEMSSISA  
(SAJMO)  
GRADE EIGHT  
ROUND ONE

DATE: 30 JULY - 3 AUGUST 2018

TIME: 90 MINUTES

### Instructions:

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2. Use the answer sheet provided.  
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4. Diagrams are not necessarily drawn to scale.
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8. Visit the website: [www.femssisa.org.za](http://www.femssisa.org.za)

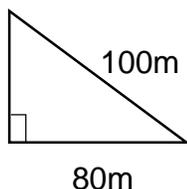


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### Grade Eight Mathematics Olympiad 2018

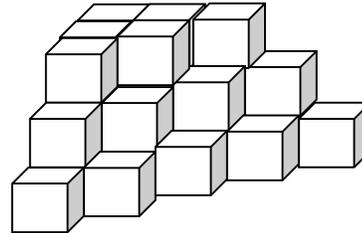
1. What is the value of  $16 \times 15 - 16 \times 16$  ?  
(A) -19      (B) -- 18      (C) -17      (D) -16      (E) - 15
2. What is 42% of R2000 + 8% of R2000?  
(A) R900      (B) R1000      (C) R1100      (D) R1200      (E)R1400
3. If  $\frac{3}{8}$  of the items produced by a factory is 360 then find what is  $\frac{2}{5}$  of the number of items?  
(A) 384      (B) 388      (C) 402      (D) 406      (E) 410
4. The supplement of an angle is  $144^\circ$ . What is the complement of the angle?  
(A)  $18^\circ$       (B)  $36^\circ$       (C)  $54^\circ$       (D)  $72^\circ$       (E)  $108^\circ$
5. Which one of the following is a rational number?  
(A)  $\frac{\sqrt{5}}{2}$       (B)  $\frac{3}{\sqrt{6}}$       (C)  $\frac{-5}{3}$       (D)  $\sqrt{8}$       (E)  $\pi$
6. The value of  $(2-3n)(3-4n)$  when  $n = -2$   
(A) 16      (B) 20      (C) 60      (D) 84      (E) 88
7. Determine the cost of enclosing the triangular plot of land at R200 per metre.



- (A) R60000      (B)R48000      (C)R8000      (D)R6000      (E)R4800
8. For what values of p will  $4571p$  is divisible by 6?  
(A) 1      (B) 4      (C) 6      (D)7      (E) 8
  9. If 16 June fell on Saturday in 2018 then in which earliest year will June 16 fall on a Saturday again?  
(A) 2022      (B) 2024      (C) 2026      (D) 2028      (E) 2034
  10. Which one of the numbers is not a term of the sequence?  
3; 10; 17; 24; .....

(A) 66      (B) 129      (C) 213      (D) 219      (E) 234

11. The LCM of 2 numbers which are in the ratio 3:4 is 96. Find the sum of the 2 numbers.  
 (A) 56      (B) 60      (C) 64      (D) 68      (E) 72
12. Identical cubes are stacked in the corner as shown. How many cubes must be added to form one large 6 by 6 cube?  
 (A) 155      (B) 170      (C) 185      (D) 201      (E) 215



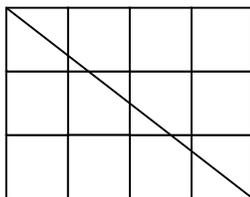
13. Consider the following sequence:-

1  
 2    3  
 4    5    6  
 .....

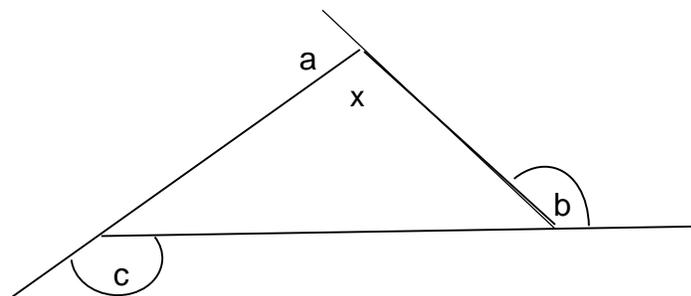
What is the 9<sup>th</sup> number of the 21<sup>st</sup> row?

- (A) 203      (B) 210      (C) 212      (D) 219      (E) 226.
14. Consider this operation on two numbers a and b.  
 $6@2 = 6$   
 $4@3 = -1$   
 $2@1 = 1$   
 What is the value of  $3@(2@5)$ ?  
 (A) 39      (B) -39      (C) 33      (D) -33      (E) 27.
15. The sum of 3 whole numbers is equal to 29. What is the greatest possible product of these 3 numbers?  
 (A) 891      (B) 900      (C) 910      (D) 920      (E) 930
16. 20 equal size matchsticks are used to form triangles.  
 What is the highest number of triangles that can be formed using all the matchsticks each time?  
 (A) 12      (B) 11      (C) 10      (D) 9      (E) 8

17. The rectangle is divided into equal squares. The diagonal passes through 6 squares. If the rectangle has length  $(p+4)$  units and the width of  $p$  units then determine in terms of  $p$  the number of squares the diagonal passes through.



- (A)  $2p+9$     (B)  $2p+7$     (C)  $2p+5$     (D)  $2p+3$     (E)  $2p+1$
18. A train 600 metre long passes through a tunnel 3 km long. The train travels at a speed of 90km per hour. How long, in seconds, will it take for the back of the train to exit the tunnel?
- (A) 124    (B) 144    (C) 164    (D) 184    (E) 204
19. Find the value of  $x$  if  $a + b = 220^\circ$  if all the sides of the triangle are produced.



- (A)  $40^\circ$     (B)  $60^\circ$     (C)  $80^\circ$     (D)  $100^\circ$     (E)  $110^\circ$
20. Two numbers from a set of natural numbers from 1 to 25 (25 consecutive numbers) are selected such that the sum is always divisible by 7. What is the least number of numbers that must be removed such that no two numbers is divisible by 7?
- (A) 11    (B) 12    (C) 13    (D) 14    (E) 15

MARKS: 1-15:  $15 \times 1 = 15$

16-20:  $5 \times 2 = 10$

TOTAL: 25



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## SOUTHERN AFRICAN JUNIOR MATHEMATICS OLYMPIAD

FEMSSISA  
(SAJMO)  
GRADE NINE  
ROUND ONE

DATE: 30 JULY-3 AUGUST 2018

TIME: 90 MINUTES

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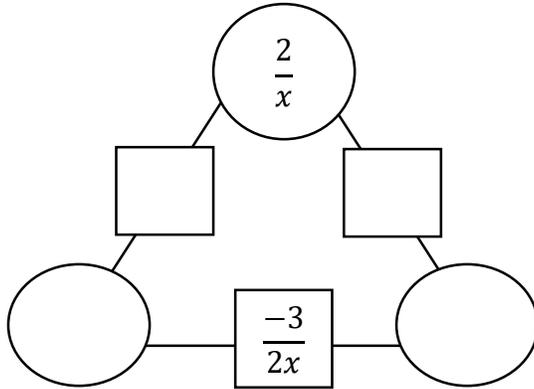
**Grade Nine Mathematics Olympiad 2018**

1. Find the value of  $6 \div (0.2)^2$   
(A) 120      (B) 150      (C) 180      (D) 210      (E) 240
2. Hima Das beat her 400 m record by 2.7 seconds. If her new record is 51.46 seconds then what was her old record in seconds?  
(A) 49.16      (B) 50.16      (C) 53.16      (D) 54.16      (E) 55.16
3. If 40% of the property is 2400m<sup>2</sup> then what is 60% of this property in m<sup>2</sup> is.....?  
(A) 2400      (B) 3000      (C) 3600      (D) 4200      (E) 4800
4. If 13 July falls on Friday in 2018, then in which earliest year will 13 July fall on a Friday again?  
(A) 2035      (B) 2036      (C) 2037      (D) 2038      (E) 2039
5. How many perfect cube natural numbers lie between  $3^3$  and  $3^6$  ?  
(A) 4      (B) 5      (C) 6      (D) 7      (E) 8
6. Write down the value of a x b if  $12x^3 - 3x = a(4x^2 - b)$   
(A) 4x      (B) 3x      (C) -2x      (D) -3x      (E) -4x
7. If  $a = 2b$  and  $3c = 2a$  then b is equal to...  
(A)  $\frac{3c}{4}$       (B)  $\frac{c}{4}$       (C)  $\frac{5c}{4}$       (D)  $\frac{4c}{3}$       (E)  $\frac{3}{4c}$
8. What is the minimum number of exercise books that can be divided equally among 6; 8 or 12 learners?  
(A) 44      (B) 48      (C) 52      (D) 56      (E) 60
9. The table below shows the relationship between x and y which is in the form  $y = mx + c$ . The equation is ...

|   |    |   |    |    |
|---|----|---|----|----|
| x | -1 | 0 | 2  | -3 |
| y | 4  | 1 | -5 | 8  |

- (A)  $y = -3x+5$     (B)  $y = -3x +2$     (C)  $y = -3x+1$     (D)  $y = 3x$     (E)  $y = 3x+1$

10.



In the above game the sum of the two expressions in the 2 circles gives the expression in the square between them. Determine the sum of the expressions in the 3 circles..

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

11. In a straight row of 150 houses every 2<sup>nd</sup> house received an electricity timer starting from house number one. Every 5<sup>th</sup> house received a voucher. How many houses received an electricity timer and a voucher ?

- (A) 89      (B) 90      (C) 91      (D) 92      (E) 93

12. Give the sum of the digits of the following product:-

$$55\,555 \times 99\,999$$

- (A) 45      (B) 54      (C) 63      (D) 72      (E) 81

13. The product of  $(2x - y)(4x^2 + 2xy + y^2)$  is ...

- (A)  $16x^3 - y^3$     (B)  $8x^3 - y^3$     (C)  $16x^3 + y^3$     (D)  $16x^3 - 2x^2y + 2xy^2 - 2y^2$     (E)  $16x^3$

14. The sum of six consecutive numbers is t. The largest number is...

- (A)  $\frac{t}{5}$       (B)  $\frac{t+2}{2}$       (C)  $\frac{t+6}{3}$       (D)  $\frac{t+6}{6}$       (E)  $\frac{t-6}{6}$

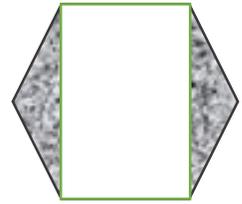
15. What is the value of :-

$$33333 \times 33335 - 33\,332 \times 33\,336 ?$$

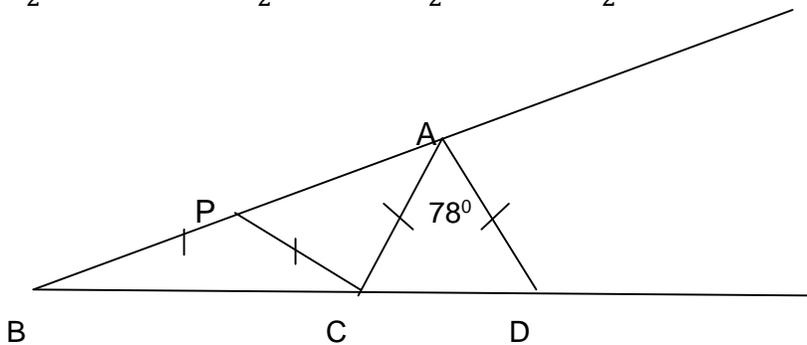
- (A) 3      (B) 4      (C) 5      (D) 6      (E) 7

16. If the area of the non-shaded region of a regular hexagon is  $p \text{ cm}^2$  then determine  
 In terms of  $p$  the area of the shaded hexagon in  $\text{cm}^2$  is...

- (A)  $\frac{2p+3}{2}$       (B)  $\frac{p+1}{2}$       (C)  $\frac{3p}{2}$       (D)  $\frac{5p}{2}$       (E)  $\frac{7p}{2}$



17.



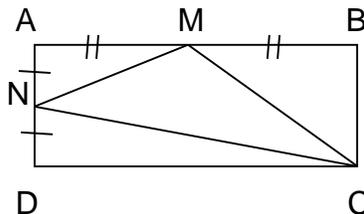
In the above figure  $PB = PC = AC = AD$ .  $\angle CAD = 78^\circ$   
 Determine the measurement of  $\angle ABD$

- (A)  $7^\circ$       (B)  $17^\circ$       (C)  $34^\circ$       (D)  $54^\circ$       (E)  $72^\circ$

18. Tina used 5 digits 2;3;6;7;8 to make 3 digit numbers with different digits. 2 cannot be used as a ten's digit and 8 cannot be used as the unit's digit. 6 cannot be used as the hundred's digit. The sum of all such 3 digit numbers is ....

- (A) 31      (B) 32      (C) 33      (D) 34      (E) 35

19. Rectangle ABCD is such that M is the midpoint of AB and N is the midpoint of BD. If the area of  $ABCD = 72 \text{ cm}^2$  then find the area of  $\triangle MNC$  in  $\text{cm}^2$ .



- (A) 24      (B) 27      (C) 30      (D) 33      (E) 36

20. 5 litres of Ruce is made up of 20% concentrate and 80% water. How many litres of concentrate must be added for the mixture to ensure that there is 62.5% water?

- (A) 1      (B) 0.9      (C) 0.8      (D) 0.7      (E) 0.6

MARKS: 1-15:  $15 \times 1 = 15$

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FEMSSISA  
GRADE TEN  
ROUND ONE

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Grade Ten Mathematics Olympiad 2018

1. What is the value of  $9 \div (0.3)^2$   
 (A) 90 (B) 100 (C) 120 (D) 200 (E) 300

2. If  $x = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$  and  $a = 5; b = -7; c = -6$  then value of  $x$  is ...  
 (A)  $\frac{1}{5}$  (B)  $\frac{-1}{5}$  (C)  $\frac{-2}{5}$  (D)  $\frac{-3}{5}$  (E)  $\frac{-4}{5}$

3. If  $f(x) = 3x^2 + x$  then the simplification of  $\frac{f(x+h) - f(x)}{h}$  if  $h \neq 0$  is equal to ...  
 (A)  $6x + 3h + 1$  (B)  $6x + h$  (C)  $6x$  (D)  $6x + 3h - 3$  (E)  $6x + 3h - 1$

4. What is the minimum number of grocery vouchers that can be shared equally among 30 ;36 or 48 people?  
 (A) 240 (B) 360 (C) 480 (D) 600 (E) 720

5. The table below shows the relationship between  $x$  and  $y$  which is in the form

$$y = \frac{a}{x+p} + q$$

$a + p + q$  is ... ..

|   |   |    |   |
|---|---|----|---|
| x | 1 | 3  | 5 |
| y | 4 | -2 | 0 |

- (A) -6 (B) -5 (C) -4 (D) -3 (E) -2
6. The equation of the line perpendicular to  $2x + 5y - 9 = 0$  and passing through  $P(0; -2)$  is...  
 (A)  $2y = 5x - 4$  (B)  $2y = 5x + 4$  (C)  $2y = 5x + 3$  (D)  $2y = 5x$  (E)  $2y = 5x - 1$
7. What is the units digit of  $5^{202} \times 3^{202} - 5^{202}$ ?  
 (A) 5 (B) 3 (C) 1 (D) 0 (E) -1
8. Factorize  $(9x - 4)^2 - (5 - 2x)^2$   
 (A)  $(11x - 9)(7x + 1)$  (B)  $(7x - 9)(9x - 1)$  (C)  $(7x - 1)(x + 9)$  (D)  $(x - 7)(6x + 1)$  (E)  $(9x - 1)(7x + 4)$
9. Alice is 2 years less than half of Beatrice's age. In 4 year's time Beatrice would be 3 times Alice's age 2 years ago. What is Beatrice's age?  
 (A) 24 (B) 26 (C) 28 (D) 30 (E) 32

10. Two towns Canterbury and Drift are 300km apart. Two cars A and B leave Canterbury and Drift at the same time travelling in opposite directions. A travels 30km/h slower than B. After two hours they were 20km apart.

What was the average speed of car B in km/h ?

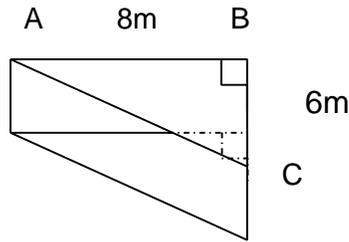
- (A) 70      (B) 75      (C) 80      (D) 85      (E) 90

11. If  $4^{2+x} = p$  then write  $2^x$  in terms of p

- (A)  $\frac{\sqrt{p}}{4}$       (B)  $\frac{\sqrt{p}}{3}$       (C)  $\frac{\sqrt{p}}{2}$       (D)  $\frac{p}{4}$       (E)  $\frac{p}{2}$

12. The cost of painting the rectangular prism at R20m<sup>2</sup> is R1680.

If AB = 8m and BC = 6m then find the height in metres.



- (A) 0.5      (B) 1      (C) 1.5      (D) 2      (E) 2.5

13. 1000 cinema tickets were sold at R100 and R60 each.

The revenue realized was R76000. How many R60 tickets were sold?

- (A) 400      (B) 600      (C) 800      (D) 900      (E) 1000

14. Solve for x

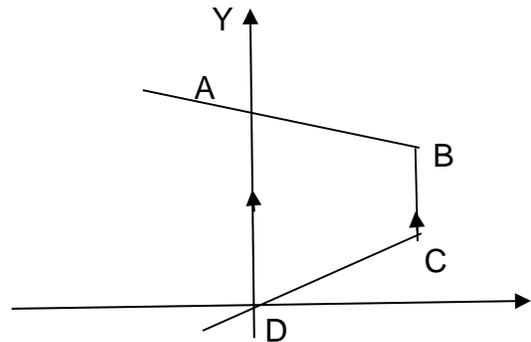
$$\frac{2x+1}{5} = \frac{1}{x-1}$$

- (A) 2 only      (B)  $\frac{-3}{2}$  only      (C) -2 only      (D)  $\frac{-3}{2}$  or  $x = 2$       (E)  $\frac{3}{2}$  or  $x = -2$

15. If  $a = 3 - \frac{3cx}{ac}$  then b = .....

- (A)  $\frac{cx-b}{a-3}$       (B)  $\frac{acx}{a-3}$       (C)  $\frac{cx}{a-3}$       (D)  $\frac{acx}{a+3}$       (E)  $\frac{acx}{a-2}$

16. A and D are the y-intercepts and  $BC \parallel AD$ . The equation of DC is  $y = \frac{3}{2}x$  and AB is  $y = -x + 14$  and the area of ABCD is 32 sq units. Determine the coordinates of B.



- (A) (4; 10)      (B) (4;6)      (C) (-4;10)      (D) (-4;6)      (E) (2;10)

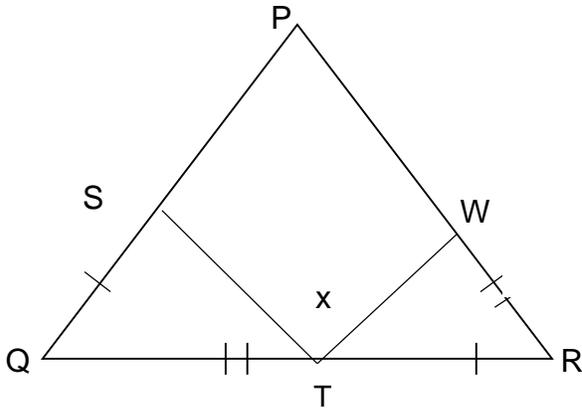
17. Solve for  $x$

$$-8 \leq 4 - 3x \leq 9$$

(A)  $\frac{-5}{3} \leq x \leq 4$  (B)  $\frac{5}{3} \leq x \leq 4$  (C)  $\frac{-1}{3} \leq x \leq 4$  (D)  $\frac{-2}{3} \leq x \leq 4$  (E)  $\frac{1}{3} \leq x \leq 4$

18. In the figure below PQR is a triangle.  $SQ = TR$ ;  $QT = WR$ .  $\hat{STW} = x$ .

Determine  $\hat{P}$  in terms of  $x$



(A)  $90^\circ - x$  (B)  $180^\circ - 2x$  (C)  $x$  (D)  $90^\circ + x$  (E)  $90^\circ - x$

19. An item was marked down by  $x\%$  during a sale. Two months later the article was marked up by  $20\%$  to bring it to its original price. Determine  $x$

(A) 20 (B) 18 (C)  $16\frac{2}{3}$  (D) 16 (E) 15

20. Three digit numbers are made from the digits 2; 4; 5; 6; 7 and 8. How many of these numbers (no digits are repeated) are divisible by 9?

(A) 9 (B) 12 (C) 15 (D) 18 (E) 21

MARKS: 1-15:  $15 \times 1 = 15$

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Grade Eleven Mathematics Olympiad 2018

1. What is the value of  $3 \cdot x^{\frac{3}{2}} = 81$

- (A) 3      (B) 4      (C) 8      (D) 9      (E) 16

2. If  $x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$  and  $y = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$  then  $\frac{x+y}{2} = \dots$

- (A)  $\frac{-b}{2a}$       (B)  $\frac{-b}{a}$       (C)  $\frac{b}{2a}$       (D)  $\frac{b}{a}$       (E)  $\frac{c}{2a}$

3. If  $f(x) = (2x - 1)(x + 2)$  then simplify  $\frac{f(x+h) - f(x)}{h}$ ;  $h \neq 0$

- (A)  $4x + 2h - 1$     (B)  $4x - 1$     (C)  $4x + h$     (D)  $4x + 2h + 3$     (E)  $4x + 1$

4. If  $f(x) = ax^n$  then  $g(x) = nax^{n-1}$

Given  $f(x) = (2x - 3)^2$  then  $g(x) = \dots\dots\dots$

- (A)  $8x - 12$     (B)  $8x + 12$     (C)  $4x - 12$     (D)  $4x + 12$     (E)  $8x$

5. Points A(1;-2) ; B(0;5) and C(3;1) are on  $y = q - \frac{a}{x-p}$ . Write down  $a+p+q$

- (A) 3      (B) 4      (C) 5      (D) 6      (E) 7

6. The equation of the line parallel to  $3y = -2x + 1$  and passing through P(-3;1) is...

- (A)  $y = 2x - 3$     (B)  $2y = -2x - 3$     (C)  $3y = -2x - 3$     (D)  $3y = -2x - 2$     (E)  $3y = -2x + 1$

7. Solve for x

$$\frac{x-3}{x+1} \leq 2$$

- (A)  $x \leq -5$  or  $x > -1$     (B)  $x \leq -5$     (C)  $x > -1$     (D)  $x > 1$     (E)  $-5 \leq x < -1$

8. If  $xy = -1$  and  $\frac{3}{x} + \frac{4}{3y} = 2$  then find the value of  $16x^2 + 81y^2$

- (A) 216      (B) 180      (C) 144      (D) 108      (E) 72

9. Solve for k

$$k^2 - k + \frac{12}{k^2 - k} = 8$$

(A) -1 or -2 only (B) -1 or 2 only (C) -1 or -2 or 2 or 3 only (D) -1 only (E) 2 only

10. When simplified to a single ratio  $\frac{\cos \phi}{1 - \sin \phi} - \frac{\cos \phi}{1 + \sin \phi}$  is equal to...

(A)  $\tan \phi$  (B)  $2 \tan \phi$  (C)  $\frac{1}{\cos \phi}$  (D)  $\sin \phi$  (E)  $\frac{1}{\tan \phi}$

11. The number  $(3200 + n)$  is divisible by 19 and 25. Find the smallest value of 'n' if n is a natural number.

(A) 125 (B) 120 (C) 100 (D) 80 (E) 60

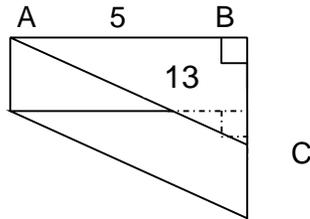
12. Did you know? Area of  $\Delta ABC = \frac{1}{2} ab \cdot \sin C$

AD bisects  $\hat{A}$  of  $\Delta ABC$  with D on BC.

.AD = .....

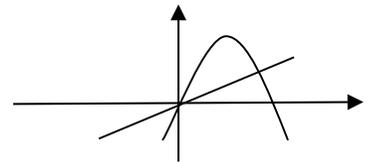
(A)  $\frac{bc}{(b+c) \sin \frac{A}{2}}$  (B)  $\frac{b}{(b+c) \sin \frac{A}{2}}$  (C)  $\frac{c}{(b+c) \sin \frac{A}{2}}$  (D)  $\frac{bc}{\sin \frac{A}{2}}$  (E)  $\frac{a}{\sin \frac{A}{2}}$

13. If the surface area of the right triangular prism with height of p cm is  $180\text{cm}^2$  then find 'p'.



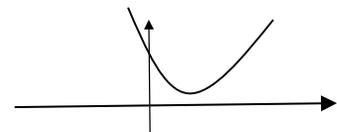
(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

14. The graph of A alongside is defined by  $f: y = -x^2 + 6x$  and  $g: y = 2x$ . What is the maximum distance between f and g?



(A) 2 (B) 3 (C) 4 (D) 5 (E) 6

15. Which one of the following statements is true in respect of the parabola  $y = ax^2 + bx + c$

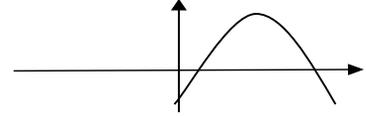


(A)  $b^2 - 4ac \leq 0$  (B)  $\frac{b}{2a} < 0$  (C)  $c < 0$  (D)  $b^2 - 4ac < 0$  (E)  $a < 0$

16. A group of 'n' persons organized a dinner and each had to pay the same amount. To cover the cost of their own tickets and that of 8 guests each to pay R20 more than the price of their own ticket. The total cost amounted to R4800. Calculate the number who attended the dinner.

(A) 36                      (B) 40                      (C) 44                      (D) 48                      (E) 52

17. The graph B alongside is defined by  $y = -x^2 + 6x - 5$ . The equation of the graph which is reflection of B about the Y-axis is...



(A)  $y = -x^2 - 6x - 5$    (B)  $y = -x^2 + 6x$    (C)  $y = -x^2 - 5$    (D)  $y = -x^2 + 5$    (E)  $y = -x^2 + 6x + 5$

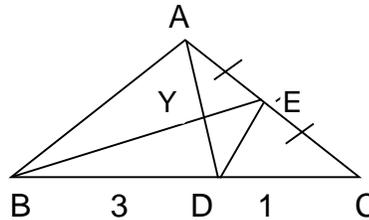
18. What is the probability digit numbers formed from the following numbers are divisible by 6?

1; 3; 5; 6; 8; 9

(A)  $\frac{21}{40}$                       (B)  $\frac{19}{40}$                       (C)  $\frac{13}{20}$                       (D)  $\frac{11}{20}$                       (E)  $\frac{9}{20}$

19. BE is a median and  $BD:DC = 3:1$   
AD intersects BE at Y.

area of EYDC = 20 cm<sup>2</sup>



The area of  $\Delta ABC = \dots$

(A) 170 cm<sup>2</sup>                      (B) 160 cm<sup>2</sup>                      (C) 150 cm<sup>2</sup>                      (D) 140 cm<sup>2</sup>                      (E) 130 cm<sup>2</sup>

20. The sum of the terms in the n<sup>th</sup> bracket is 2943? These are all consecutive natural numbers. The value of 'n' is...

(2);(3;4);(5;6;7);(8;9;10;11);.....

(A) 26                      (B) 24                      (C) 22                      (D) 20                      (E) 18

MARKS: 1-15: 15 X 1 = 15

16-20: 5 X 2 = 10

TOTAL: 25