

SOUTHERN AFRICAN JUNIOR MATHEMATICS OLYMPIAD

FEMSISA MATHEMATICS OLYMPIAD

(SAJMO)

GRADE EIGHT

ROUND ONE

DATE: 28 – 31MAY 2013

TIME: 90 MINUTES

Instructions:

1. This booklet has 20 multiple choice questions.
2. Use the answer sheet provided.
Circle the letter corresponding to your answer.
3. All working details must be done in the space provided.
3. Calculators are not permitted..
4. Diagrams are not necessarily drawn to scale.
5. The first 15 problems carry one mark each and the next 5 carry 2 marks each.
In order to qualify for the second round you need 7 out of 25 marks.
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Grade Eight Mathematics Olympiad 2013

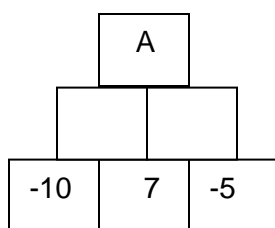
1. What is the value of : $48 \times (10 - \frac{1}{6})$?

- (A) 456 (B) 464 (C) 472 (D) 480 (E) 488

2. What is 11% of R400 + 9% of R400?

- (A) R64 (B) R68 (C) R72 (D) R76 (E) R80

3. In the following game the sum of two numbers in the blocks underneath gives the number in the block above. Find the value of A.



- (A) -2 (B) -1 (C) 0 (D) 1 (E) 2

4. If the complement of an angle is 55° then what is the supplement of the angle?

- (A) 45° (B) 65° (C) 95° (D) 135° (E) 165°

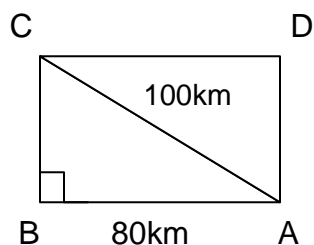
5. Which one of the following is an irrational number?

- (A) $\sqrt{36}$ (B) $\sqrt{81}$ (C) $\sqrt[3]{64}$ (D) $\sqrt{48}$ (E) $\sqrt[3]{125}$

6. For what values of m is $324m^2$ divisible by 18 if $m \neq 0$?

- (A) 8 (B) 6 (C) 4 (D) 3 (E) 2

7. Govan travelled from C to A ; A to B; B to C; C to D and D to A and from A to C. ABCD is a rectangle. CA = 100km; AB = 80km. Calculate the distance covered by Eric.



- (A) 380km (B) 480km (C) 540km (D) 600km (E) 660km

8. How many odd perfect squares are there from 0 to 500?

- (A) 9 (B) 10 (C) 11 (D) 12 (E) 50

9. If 27 April falls on Saturday 2013 then in which earliest year will 27 April fall on a Tuesday?

- (A) 2014 (B) 2015 (C) 2016 (D) 2019 (E) 2021

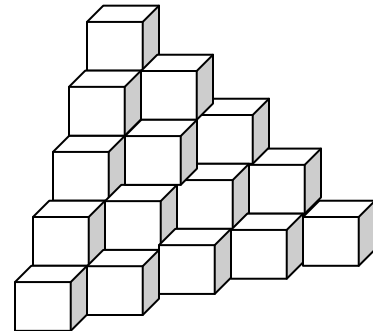
10. What is the value of m if $240^2 - m^2 = 479$

- (A) 239 (B) 241 (C) 243 (D) 245 (E) 247

11. The formula to calculate the cost of telephone usage in rands is given as follows: $A = 0.75x + 240$. If $A = R577.50$ then find the number of call units ' x '.

- (A) 300 (B) 350 (C) 400 (D) 450 (E) 500

12. Identical cubes are stacked in the corner as shown. How many cubes are needed to make one large cube?



- (A) 35 (B) 90 (C) 125 (D) 135 (E) 145

13. Consider the following sequence:-

1
2 3
4 5 6

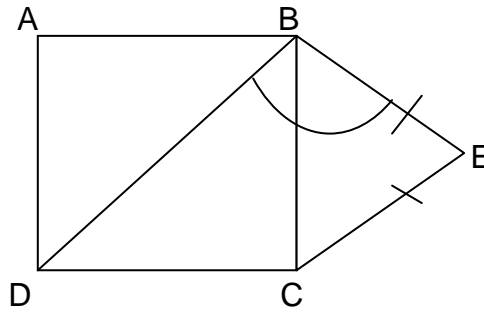
.....
What is the 3rd number of the 40th row?

- (A) 817 (B) 819 (C) 821 (D) 823 (E) 825

14. The value of $(2-3n)(2n+1)(1-3n)$ when $n = 2$ is

- (A) -80 (B) -90 (C) -100 (D) 90 (E) 100

15. ABCD is a square. $\triangle BEC$ is isosceles. $\hat{BEC} = 50^\circ$. Calculate \hat{DBE} .



- (A) 100° (B) 105° (C) 110° (D) 115° (E) 120°

16. Penny travels from town A to B at an average speed of 90km/h. Her return journey takes 30 minutes quicker because she travelled at an average speed of 110km per hour. What is the distance in km from town A to B?

- (A) 247.5 (B) 252,5 (C) 257.5 (D) 262.5 (E) 267.5

17. Consider this operation on two numbers a and b.

$$a @ b = a^2 + 2ab + b^2$$

What is the value of $3 @ - 4$?

- (A) -1 (B) 0 (C) 1 (D) 2 (E) 3

18. Write down the units digit of:-

$$16^9 - (113^9 - 103^9)$$

- (A) 0 (B) 1 (C) 3 (D) 6 (E) 7

19. The difference of squares of two consecutive numbers is P. The smaller number is...

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

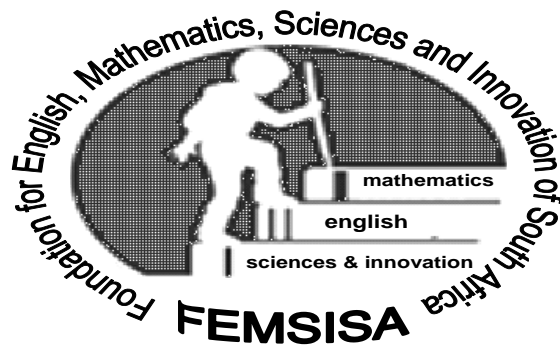
20. There are 4 different weights 1kg; 2kg; 4kg and 8kg. How many different objects can be weighed with these weights?

- (A) 4 (B) 5 (C) 6 (D) 7 (E) 15

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

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

TOTAL: 25



SOUTHERN AFRICAN JUNIOR MATHEMATICS OLYMPIAD

FEMSISA MATHEMATICS OLYMPIAD

(SAJMO)

GRADE NINE

ROUND ONE

DATE: 28-31 MAY 2013

TIME: 90 MINUTES

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Grade Nine Mathematics Olympiad 2013

1. Find the value of $6.5 \times 0.4 \div 0.5$

- (A) 0.0052 (B) 0.052 (C) 0.52 (D) 5.2 (E) 52

2. If 20 litres of diesel cost R192 then what will 25 litres of diesel at the same rate cost?

- (A) R240 (B) R250 (C) R260 (D) R270 (E) R280

3. The initial price of an article was increased by 30% and the later by another 20%. Determine the mark up as a single percentage on the initial price.

- (A) 50% (B) 56% (C) 60% (D) 62% (E) 64%

4. If 16 June falls on Sunday in 2013, then in which earliest year will 16 June fall on a Sunday again?

- (A) 2016 (B) 2017 (C) 2018 (D) 2019 (E) 2021

5. How many perfect cubes natural numbers lie between 200 and 600 ?

- (A) 1 (B) 2 (C) 3 (D) 133 (E) 134

6. Write down the value of $a + b$ if $12x^2 + 8x = a(3x + b)$

- (A) 6 (B) $2x-2$ (C) $4x-2$ (D) $2x$ (E) $4x+2$

7. If $b = 2a$ and $3c = -4b$ then $a + b + c$ is equal to...

- (A) $\frac{b+3}{2}$ (B) $\frac{b}{6}$ (C) $\frac{6}{b}$ (D) $\frac{7}{b}$ (E) $\frac{b}{7}$

8. Give the sum of the last 4 digits of $77\ 777 \times 55\ 555$.

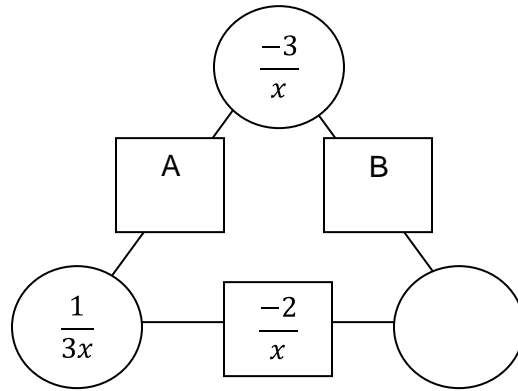
- (A) 8 (B) 10 (C) 11 (D) 12 (E) 13

9. The table below shows the relationship between x and y which is in the form $y = mx + c$. The equation is ...

x	0	1	2	3
y	-3	2	7	12

- (A) $y = 4x-3$ (B) $y = 3x - 3$ (C) $y = 5x-3$ (D) $y = x-3$ (E) $y = 4x-1$

10.



In the above game the sum of the two expressions in the circles gives the expression in the square between them. Determine the expression of $A + B$.

- (A) $\frac{-2}{3x}$ (B) $\frac{-x}{8}$ (C) $\frac{x}{8}$ (D) $\frac{-8}{3x}$ (E) $\frac{-8}{x}$

11. In a straight row of 200 houses every 4th flowering plant starting from house number one. Every 6th house received a non flowering plant starting from house number one. How many houses received both the flowering and non flowering plants?

- (A) 13 (B) 15 (C) 17 (D) 19 (E) 21

12. Give the value of $(1-4n)(2-3n)(4-n)$ if $n = -2$

- (A) 108 (B) -216 (C) 216 (D) 432 (E) -432

13. Give the units digit of:-

$$35^{10} - (19^{10} - 9^{10})$$

- (A) 5 (B) 9 (C) 3 (D) 0 (E) 7

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

- (A) $8x^3 + y^3$ (B) $8x^3 - 4x^2y + 4xy^2 - y^3$ (C) $8x^3 - y^3$ (D) $8x^3 - 2x^2y + 2xy^2 - 2y^2$ (E) $8x^3$

15. Find the value of 'x' such that $\frac{1}{x}$ is the same distance from $\frac{4}{15}$ as it is from $\frac{7}{30}$.

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

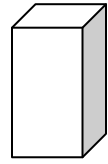
16. What is the value of :-

$$5557 \times 5553 - 5556 \times 5554?$$

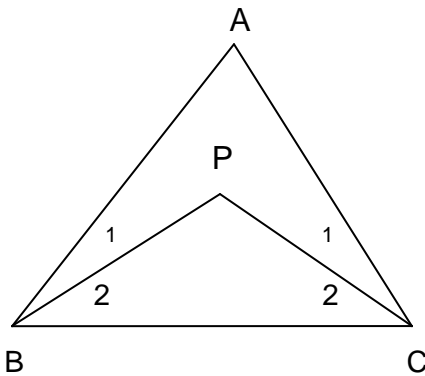
- (A) 1 (B) -2 (C) 2 (D) -3 (E) 3

17. A rectangular container has a square base with its height is 3 times the length of the base. The surface area of this closed container is 504cm^2 . Calculate the capacity of this container in ml .

(A) 360 (B) 500 (C) 600 (D) 640 (E) 648



18.

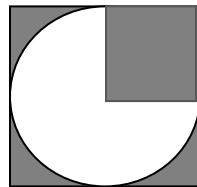


In the above figure $\hat{B}_1 = \hat{B}_2$; $\hat{C}_1 = \hat{C}_2$ $B\hat{P}C = 130^\circ$. Calculate \hat{A} .

(A) 80° (B) 65° (C) 50° (D) 40° (E) 36°

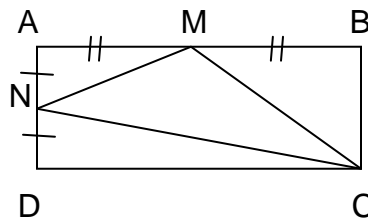
19. A circle is drawn to touch the 4 sides of the square.

Calculate the radius of the circle in metres if the area of the shaded region = $16 - 3\pi$.



(A) 0.5 (B) 1 (C) 1.2 (D) 1,5 (E) 2

20. Rectangle ABCD is such that M is the midpoint of AB and N is the midpoint of BD. If the area of $\Delta MNC = 36\text{ cm}^2$ then find the area of ABCD in cm^2 .

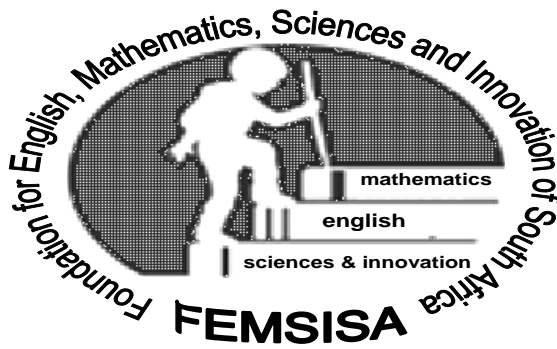


(A) 54 (B) 72 (C) 84 (D) 96 (E) 108

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

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

TOTAL: 25



SOUTHERN AFRICAN JUNIOR MATHEMATICS OLYMPIAD

FEMSISA MATHEMATICS OLYMPIAD

(SAJMO)

GRADE TEN

ROUND ONE

DATE: 28-31MAY 2013

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Grade Ten Mathematics Olympiad 2013

1. What is the value of $(0.1)^2 - (0.1)^3$

- (A) 0.1 (B) 0.01 (C) 0.009 (D) 0.09 (E) 0.9

2. If $x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$ and $a = 2; b = -7; c = 3$ then value of x is ...

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

3. If $f(x) = x^2 + 2x$ then simplify $f(x+h) - f(x)$

- (A) 0 (B) $2xh - h^2$ (C) $2xh + h^2$ (D) $2xh + h^2 - 2h$ (E) $2xh + h^2 + 2h$

4. Factorize

$$(5x - 1)^2 - (2 - 3x)^2$$

- (A) $(8x+3)(2x+1)$ (B) $(8x-3)(2x-1)$ (C) $(8x-3)(2x+1)$ (D) $(x-3)(2x+1)$ (E) $(8x-3)(x+1)$

5. The table below shows the relationship between x and y which is in the form $y = \frac{a}{x-p}$. The equation is ...

x	-1	0	2
y	-2	-4	4

- (A) $y = \frac{-8}{x-3}$ (B) $y = \frac{8}{x-3}$ (C) $y = \frac{-4}{x-1}$ (D) $y = \frac{x+2}{x}$ (E) $y = \frac{4}{x-1}$

6. The equation of the line perpendicular to $2y = x - 4$ and passing through $P(-1;0)$ is...

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

7. Evaluate

$$3543 \times 3546 - 3541 \times 3548$$

- (A) 8 (B) 10 (C) 12 (D) 3544 (E) 3545

8. What is the units digit of $9^{101} \times 4^{101}$?

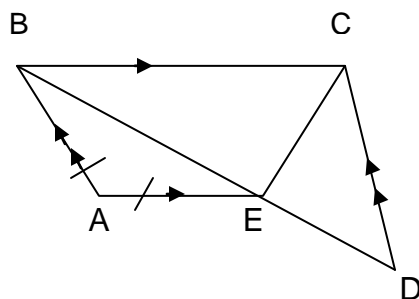
- (A) 4 (B) 6 (C) 1 (D) 9 (E) 5

9. Sarah is 24 years older than her daughter Pam. Seven years ago she was 4 times as old as Pam. What is Pam's age?

- (A) 33 (B) 35 (C) 37 (D) 39 (E) 41

10. In the figure below BED is a straight line. $AB = AE$. $\hat{A} = 80^\circ$; $\hat{E}CD = 40^\circ$.

Calculate \hat{DEC} .

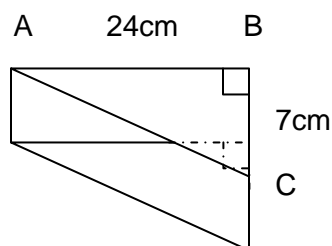


- (A) 90° (B) 80° (C) 70° (D) 60° (E) 50°

11. If $x - y = 4$ and $xy = 3$ then the value of $x^2 + y^2$ is ...

- (A) 9 (B) 13 (C) 16 (D) 19 (E) 22

12. Calculate the surface area of the right triangular prism in cm^2 if the height of the prism is 15cm.



- (A) 960 (B) 840 (C) 720 (D) 600 (E) 560

13. If $8^{1-x} = t$ then write down in terms of t the value of 2^x

- (A) $\sqrt[3]{\frac{t}{8}}$ (B) $\sqrt[3]{8t}$ (C) $\sqrt[3]{\frac{8}{t}}$ (D) $\sqrt[3]{2t}$ (E) $\sqrt[3]{\frac{2}{t}}$

14. Solve for x

$$\frac{3x}{x-1} - 2 = \frac{2x}{2x-1}$$

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

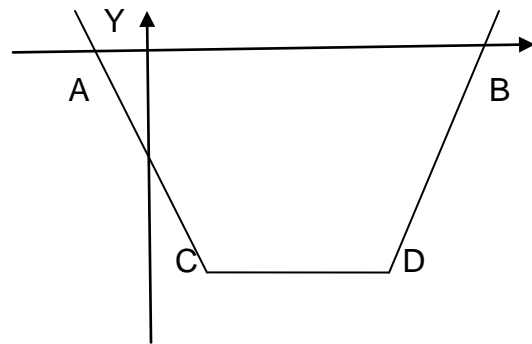
15. If $a = \frac{bc}{b+c}$ then $c = \dots$

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

16. If $2a = c$ and $2b = 5c$ then $a - b + c$ is equal to...

- (A) $-c$ (B) c (C) $\frac{c}{2}$ (D) $\frac{c}{3}$ (E) $\frac{-c}{2}$

17. C and D are the x-intercepts and $AB \parallel CD$. The equation of CD is $y = -4$ and AC is $y = -x - 2$ and the area of ABCD is 22 sq units. Determine the equation of BD in the form $y = mx + c$ if the x intercept at B is 6.



- (A) $y = x + 6$ (B) $y = 3x - 24$ (C) $y = 3x + 24$ (D) $y = 4x + 24$ (E) $y = 4x - 24$

18. Solve for x

$$0 \leq 3 - 4x \leq 75$$

- (A) $18 \leq x \leq \frac{3}{4}$ (B) $-18 \leq x \leq \frac{3}{4}$ (C) $\frac{3}{4} \leq x \leq 18$ (D) $3 \leq x \leq 18$ (E) $4 \leq x \leq 18$

19. 8 litres of Energy Drink is made up of 40% concentrate and 60% water. How many litres of concentrate must be added for the mixture to ensure that there is 60% concentrate?

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

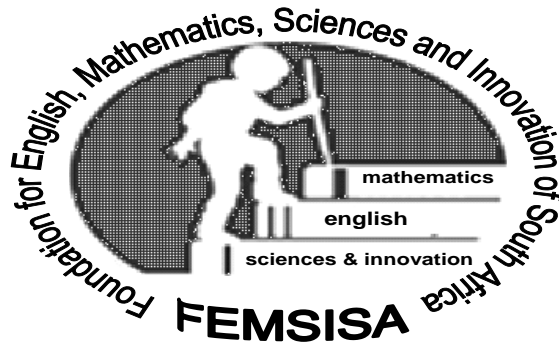
20. Allan completed three quarters of the distance at an average speed of 72km/h. He completed the entire distance at an average speed of 60km/h. What was the average speed in km/h over the remaining quarter of the distance?

- (A) 32 (B) 36 (C) 40 (D) 44 (E) 48

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

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

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FEMSISA MATHEMATICS OLYMPIAD

(SAJMO)

GRADE ELEVEN

ROUND ONE

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Grade Eleven Mathematics Olympiad 2013

1. What is the value of $(0.1)^2 - (0.1)^3 - (0.1)^4$

- (A) 0.89 (B) 0.09 (C) 0.089 (D) 0.009 (E) 0.0089

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

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

3. If $f(x) = x^2 - 2x - 3$ then simplify $\frac{f(x+h) - f(x)}{h}$

- (A) $2x + h - 2$ (B) $2x - 2$ (C) $2x + h$ (D) $h - 2$ (E) $2x^2 + h - 2$

4. Solve for x

$$(x^2 - 7)^2 - 11(x^2 - 7) + 18 = 0$$

- (A) 3 only (B) 4 only (C) $\pm 3; \pm 4$ (D) $\pm 3; 4$ only (E) $\pm 2; \pm 3$

5. The table below shows the relationship between x and y which is in the form $y = \frac{a}{2x+c}$. The equation is ...

x	0	1	2
y	-3	3	1

- (A) $y = \frac{-3}{x+1}$ (B) $y = \frac{9}{x-3}$ (C) $y = \frac{6}{x-2}$ (D) $y = \frac{3}{2x-1}$ (E) $y = \frac{3}{2x+1}$

6. The equation of the line perpendicular to $3y = 2x + 3$ and passing through P(-3;0) is...

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

7. Solve for x

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

- (A) $2 \leq x \leq 4$ (B) $2 < x \leq 4$ (C) $x < 2$ or $x \geq 4$ (D) $x \leq 2$ or $x \geq 4$ (E) $x > 2$

8. If $xy = 2$ and $\frac{1}{x} + \frac{1}{y} = 5$ then find the value of $x^2 + y^2$

- (A) 96 (B) 84 (C) 72 (D) 54 (E) 24

9. . If $8^{1-x} = t$ then write down in terms of t the value of 2^{2-x} is...

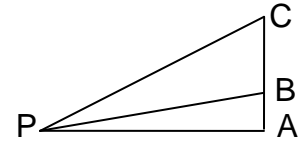
- (A) $\sqrt[2]{2t}$ (B) $\sqrt[2]{8t}$ (C) $\sqrt[3]{2t}$ (D) $\sqrt[3]{4t}$ (E) $\sqrt[3]{8t}$

10. When simplified to a single ratio

$\frac{\cos x}{1-\sin x} - \tan x$ is equal to...

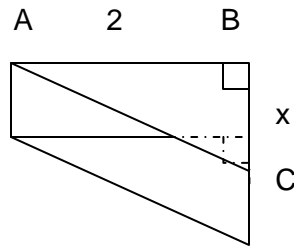
- (A) $\frac{1}{\sin x}$ (B) $\frac{1}{\cos x}$ (C) $\frac{1}{\tan x}$ (D) $\frac{1}{\cos x-1}$ (E) $\frac{1}{\sin x-1}$

11. A cellphone mast is placed 40metres above the top of a hill. The angle of elevation from P to the top of the hill and the top of the mast is 10° and 30° respectively. The height of AB is given by:-



- (A) $\frac{40 \tan 10^\circ}{\tan 30^\circ + \tan 10^\circ}$ (B) $\tan 30^\circ - \tan 10^\circ$ (C) $\frac{40 \tan 10^\circ}{\tan 30^\circ}$ (D) $\frac{40 \tan 10^\circ}{\tan 30^\circ - \tan 10^\circ}$ (E) $\frac{40 \tan 30^\circ}{\tan 10^\circ}$

12. If the surface area of the right triangular prism with h of 4cm is 27cm^2 then find 'x'.

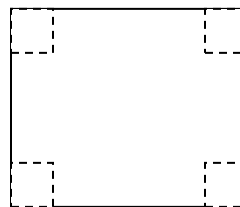


- (A) 3cm (B) 2.5cm (C) 2.0cm (D) 1.5cm (E) 1cm

13. The number $(2200 + n)$ is divisible by 17 and 23. Find the smallest value of 'n'.

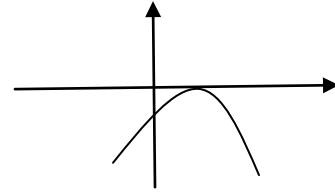
- (A) 8 (B) 122 (C) 146 (D) 245 (E) 537

14. The 4 corners of a square piece of cardboard of side 24cm are cut off as shown. The corner pieces are folded to form a box. What must the side (integral value) of the 4 small squares be to give the box the maximum volume?



- (A) 2cm (B) 4cm (C) 6cm (D) 8cm (E) 12cm

15. Which one of the following statements is not true in respect of the parabola $y=ax^2+bx+c$

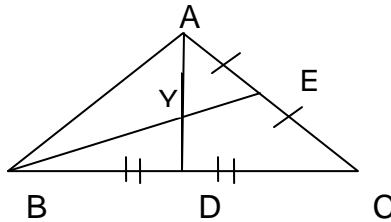


- (A) $b^2-4ac = 0$ (B) $\frac{b}{2a} \leq 0$ (C) $c < 0$ (D) $\frac{b}{2a} < 0$ (E) $a < 0$

16. BE and AD are medians.

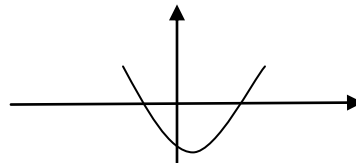
Find the ratio of

$$\frac{\text{area of } \triangle AYB}{\text{area of } \triangle ABC}$$



- (A) $\frac{1}{6}$ (B) $\frac{1}{4}$ (C) $\frac{1}{2}$ (D) $\frac{2}{3}$ (E) $\frac{1}{3}$

17. The graph A alongside is defined by $y = x^2 - 3x - 4$. The equation of the graph which is reflection of A about the Y-axis



- (A) $y = x^2 + 3x - 4$ (B) $y = x^2 + 3x$ (C) $y = x^2 - 3x$ (D) $y = -x^2 + 4$ (E) $y = -x^2 - 3x + 4$

18. What is the 1000th term of the series?

$$\frac{1}{1} + \frac{1}{2} + \frac{2}{2} + \frac{1}{3} + \frac{2}{3} + \frac{3}{3} + \frac{1}{4} + \frac{2}{4} + \frac{3}{4} + \frac{4}{4} + \dots$$

- (A) $\frac{30}{44}$ (B) $\frac{20}{45}$ (C) $\frac{15}{46}$ (D) $\frac{20}{47}$ (E) $\frac{23}{48}$
19. 6 litres of Fruit Drink 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 40% concentrate?

- (A) 3.6 (B) 2.8 (C) 2.4 (D) 2 (E) 1.8

20. Des completed one third of the distance at an average speed of 90km/h. He completed the next one fifth of the distance at an average speed of 108km/h. He completed the entire distance at an average speed at 90 km/h. What was the average speed over the remaining part of the distance?

- (A) 72km/h (B) 80km/h (C) 84km/h (D) 96km/h (E) 108km/h

MARKS: 1-15: 15 X 1 = 15

16-20: 5 X 2 = 10

TOTAL: 25