



science
& technology

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

SOUTHERN AFRICAN JUNIOR MATHEMATICS OLYMPIAD

FEMSSISA
(SAJMO)
GRADE EIGHT
ROUND ONE
DATE: 7-10 AUGUST 2017
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.
6. You have 90 minutes for the paper which works out to an average of 4.5 minutes per question.
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NON PROFIT MAKING COMPANY
REGISTRATION NO: 2015/050119/08



Grade Eight Mathematics Olympiad 2017

1. What is the value of $6 \times 2 - 7 \times 6$?

- (A) -42 (B) -- 36 (C) -30 (D) -24 (E) - 20

2. What is 21% of R900 + 9% of R900?

- (A) R210 (B) R270 (C) R330 (D) R390 (E) R450

3. If $\frac{3}{8}$ of the items produced by a plant is 300 then find what is $\frac{1}{2}$ of the number of items?

- (A) 400 (B) 440 (C) 480 (D) 520 (E) 560

4. The difference between the supplement and the complement of an angle is

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

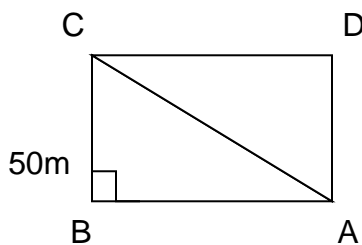
5. Which one of the following is not an irrational number?

- (A) $\frac{\pi}{2}$ (B) $\sqrt{5}$ (C) $\sqrt[3]{12}$ (D) $\sqrt[3]{64}$ (E) $3 + \sqrt{2}$

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

- (A) -502 (B) 504 (C) -506 (D) 508 (E) 510

7. The perimeter of rectangle ABCD is 340m. If CB = 50m then what is the length of CA in metres?



- (A) 100 (B) 110 (C) 120 (D) 130 (E) 140

8. For what values of m will $457m^2m$ is divisible by 12?

- (A) 8 (B) 6 (C) 4 (D) 2 (E) 0

9. Sal will be 18 years on Saturday 12 August 2017. On which day of the week was she born?

- (A) Thursday (B) Friday (C) Saturday (D) Sunday (E) Monday

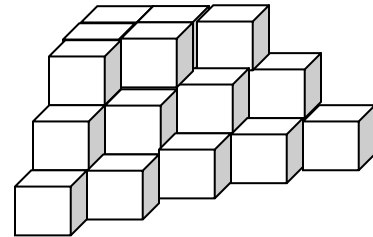
10. What is the value of: $8^3 \times 5^4$

- (A) 400 000 (B) 40 000 (C) 320 000 (D) 32 000 (E) 30 000

11. The LCM of 2 numbers which are in the ratio 5:4 is 240. Find the sum of the 2 numbers.

- (A) 104 (B) 108 (C) 112 (D) 116 (E) 120

12. Identical cubes are stacked in the corner as shown. How many cubes must be added to form one large cube?



- (A) 88 (B) 90 (C) 92 (D) 94 (E) 96

13. Consider the following sequence:-

1
3 5
7 9 11
.....

What is the 4th number of the 31st row?

- (A) 907 (B) 917 (C) 927 (D) 937 (E) 947

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

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

What is the value of $3 @ - 5$?

- (A) -46 (B) 48 (C) -50 (D) 52 (E) -54

15. Write down the unit's digit of

$$35^{50} + 16^6 - 25^{49}$$

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

16. Lesley can do a job in 8 hours. Petros can do the same job in 6 hours. If both work together then determine the time in hours it will take to do the same job working at the same rate.

- (A) $5\frac{1}{7}$ (B) $4\frac{5}{7}$ (C) $4\frac{3}{7}$ (D) $3\frac{5}{7}$ (E) $3\frac{3}{7}$

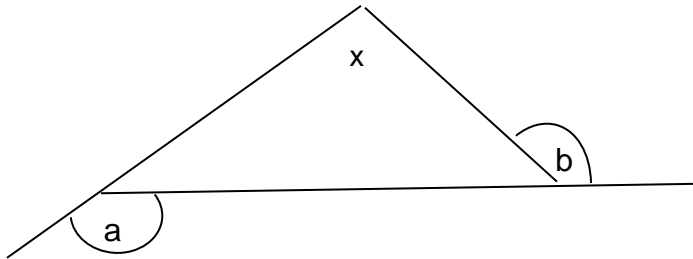
17. The surface area of the closed rectangular prism is 1056 cm^2 .
The height is 12 cm and the width is 9 cm . The length in cm is...

- (A) 16 (B) 18 (C) 20 (D) 22 (E) 24

18. A train from Embury to Trinity travels at a speed of 120 km per hour . A train from Trinity to Embury travels at an average speed of $x \text{ km/h}$. The distance from Embury to Trinity is $(x + 10) \text{ km}$. The two trains passed each other after 30 minutes after leaving at the same time. The speed of the train from Trinity to Embury in km/h was...

- (A) 88 (B) 92 (C) 96 (D) 100 (E) 104

19. Find the value of x if $a + b = 290^\circ$



- (A) 100° (B) 110° (C) 120° (D) 130° (E) 140°

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. How many such combinations are there?

- (A) 92 (B) 90 (C) 88 (D) 86 (E) 84

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

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

TOTAL: 25



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FEMSSISA
(SAJMO)
GRADE NINE
ROUND ONE

DATE: 7-10 AUGUST 2017
TIME: 90 MINUTES

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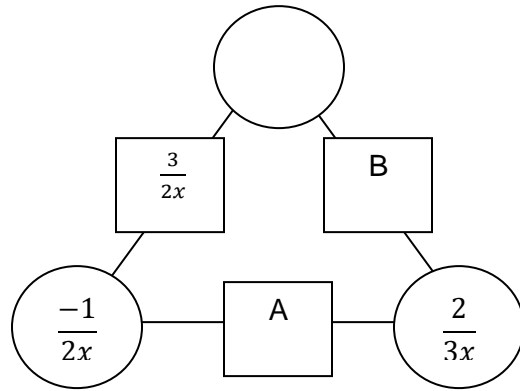
Grade Nine Mathematics Olympiad 2017

1. Find the value of $28 \div 0.7$
(A) 240 (B) 280 (C) 320 (D) 360 (E) 400
2. If 25 kg rice cost R210 then what will 15 kg of rice at the same rate cost?
(A) R100 (B) R124 (C) R126 (D) R128 (E) R130
3. The initial price of an article was decreased by 20% and the later by another 10%. Determine the mark down as a single percentage on the initial price.
(A) 27.5% (B) 28% (C) 28.5% (D) 29% (E) 29.5%
4. If 9 August falls on Wednesday in 2017, then in which earliest year will 9 August fall on a Wednesday again?
(A) 2023 (B) 2024 (C) 2025 (D) 2026 (E) 2027
5. How many perfect cubes natural numbers lie between 50 and 500 ?
(A) 7 (B) 6 (C) 5 (D) 4 (E) 3
6. Write down the value of $a \times b$ if $25y^3 - 15y = a(5y^2 - b)$
(A) -15 (B) 5y (C) -5y (D) 15y (E) -15y
7. If $a = 3b$ and $4b = 3c$ then $a + b + c$ is equal to...
(A) $\frac{5c+2}{2}$ (B) $\frac{5c}{2}$ (C) $\frac{2}{5c}$ (D) $\frac{-5}{c}$ (E) $\frac{5c}{3}$
8. The sum of the digits of the products are found:
. 5×6 ; 55×66 ; 555×666 ; 5555×6666
Each sum is always divisible by.....
(A) 2 (B) 3 (C) 4 (D) 5 (E) 9
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	1
y	-9	-3	3

- (A) $y = 3x-1$ (B) $y = 9x$ (C) $y = x-3$ (D) $y = 4x-3$ (E) $y = 6x-3$

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 expression of $A + B$.

- (A) $\frac{17}{6x}$ (B) $\frac{-17}{6x}$ (C) $\frac{8}{3x}$ (D) $\frac{2}{2x}$ (E) $\frac{-8}{3x}$

11. Debbie had 20c and 50c coins only. In how many ways could she have given change for R9 ?

- (A) 9 (B) 10 (C) 11 (D) 12 (E) 13

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

- (A) 300 (B) 360 (C) -360 (D) 495 (E) -495

13. The sum of 5 consecutive odd numbers is p . The largest number in terms of p is...

- (A) $p - 4$ (B) $\frac{p}{5} + 4$ (C) $2p + 4$ (D) $p + 2$ (E) $p - 2$

14. The product of $(4x - y)(16x^2 + 4xy + y^2)$ is ...

- (A) $64x^3 - y^3$ (B) $16x^3 - 4x^2y + 4xy^2 - y^3$ (C) $16x^3 + y^3$ (D) $16x^3 - 2x^2y + 2xy^2 - 2y^2$ (E) $16x^3$

15. David had R3500. He added an amount n such that it could be divided equally among 6 ; 9 or 24 people. What is the minimum value in rands he could have added?

- (A) 100 (B) 64 (C) 52 (D) 40 (E) 28

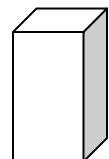
16. What is the value of :-

$$2424 \times 2427 - 2425 \times 2426?$$

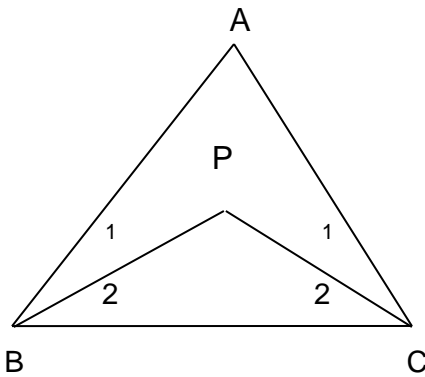
- (A) 1 (B) 3 (C) 2 (D) -3 (E) -2

17. A rectangular container has a rectangular base with its length 3 times its width. The height is 7cm more than its width. The surface area of this closed container is 630cm^2 . Calculate the capacity of this container in ml .

- (A) 1650 (B) 760 (C) 720 (D) 680 (E) 640



18.



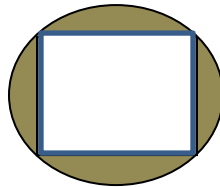
In the above figure $\hat{B}_1 = 2\hat{B}_2$; $\hat{C}_1 = 2\hat{C}_2$; $\hat{A} = 60^\circ$. Calculate $B\hat{P}C$.

- (A) 110° (B) 120° (C) 130° (D) 140° (E) 150°

19. A circle is drawn to pass through the vertices of the square.

If the area of the square is 98 cm^2 then determine the area of the shaded region

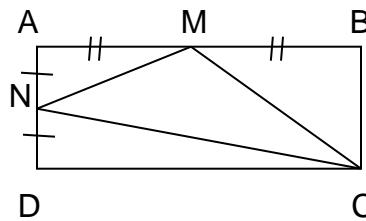
In cm^2 if the value of $\pi = \frac{22}{7}$



- (A) 49 (B) 52 (C) 56 (D) 64 (E) 77

20. Rectangle ABCD is such that M is the midpoint of AB and N is the midpoint of BD.

If the area of ABCD = 192 cm^2 then find the area of $\triangle MNC$ in cm^2



- (A) 120 (B) 108 (C) 96 (D) 84 (E) 72

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

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GRADE TEN
ROUND ONE

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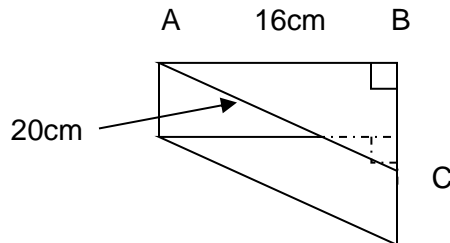


1. What is the value of $(0.3)^2 \div (0.01)^2$
- (A) 1200 (B) 900 (C) 800 (D) 600 (E) 300
2. If $x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$ and $a = 6; b = -1; c = -12$ then value of x is ...
- (A) $\frac{3}{2}$ (B) $\frac{-4}{3}$ (C) $\frac{5}{2}$ (D) $\frac{-5}{2}$ (E) $\frac{1}{3}$
3. If $f(x) = 2x^2 - 3x$ then the simplification of $\frac{f(x+h) - f(x)}{h}$ if $h \neq 0$ is equal to ...
- (A) $4x + 2h + 1$ (B) $4x + h$ (C) $4x$ (D) $4x + 2h - 3$ (E) $4x + h - 1$
4. What is the minimum number of pears that can be shared equally among 24 ;30 or 60 people?
- (A) 600 (B) 480 (C) 360 (D) 240 (E) 120
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 | -3 | 0 | 2 |
| y | $\frac{1}{2}$ | 1 | 3 |
- (A) $y = \frac{-2}{x-2}$ (B) $y = \frac{-3}{x+3}$ (C) $y = \frac{-3}{x-3}$ (D) $y = \frac{2}{x+3}$ (E) $y = \frac{2}{x-3}$
6. The equation of the line perpendicular to $3x - 2y - 6 = 0$ and passing through $P(0, -3)$ is...
- (A) $3y = -x + 1$ (B) $3y = 2x - 9$ (C) $3y = -2x - 9$ (D) $3y = 2x$ (E) $3y = -2x$
7. What is the units digit of $5^{200} \times 3^{202}$?
- (A) 5 (B) 6 (C) 7 (D) 8 (E) 9
8. Factorize
- $$(7x - 2)^2 - (3 - x)^2$$
- (A) $(8x-5)(6x+1)$ (B) $(8x-3)(4x-1)$ (C) $(2x-3)(x-9)$ (D) $(8x-5)(6x-1)$ (E) $(6x-1)(4x+7)$
9. Amy is 10 years older than Tembi. In 4 year's time Amy will be twice as old as Tembi. What is Amy's age?
- (A) 20 (B) 18 (C) 16 (D) 14 (E) 12

10. Two towns Appleberry and Baryston are 400km apart. Two cars A and B leave Appleberry and Baryston at the same time travelling in opposite directions. A travels 20km/h slower than B. After two hours they were 40km apart.

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

- (A) 88 (B) 92 (C) 96 (D) 100 (E) 104
11. If $9^{2-x} = t$ then write 3^{2x} in terms of t
- (A) $\frac{81}{t}$ (B) $\frac{27}{t}$ (C) $\frac{9}{t}$ (D) $\frac{3}{t}$ (E) $\frac{81}{2t}$
12. Calculate the surface area of the right triangular prism in cm^2 if the height of the prism is 15 cm; AB = 16cm and AC = 20cm

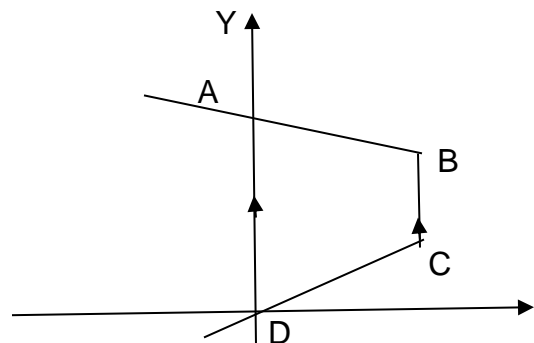


- (A) 888 (B) 900 (C) 912 (D) 924 (E) 936
13. Tickets for a netball match were sold for R80 and R30. 2000 tickets were sold. The revenue from the sale of tickets was R100 000. How many R80 tickets were sold?

- (A) 400 (B) 600 (C) 800 (D) 1000 (E) 1200
14. Solve for x
- $$\frac{3x}{x-1} + 2 = \frac{-1}{2x}$$
- (A) $\frac{1}{2}$ only (B) $\frac{-1}{5}$ only (C) $\frac{-1}{5}$ or $\frac{1}{2}$ (D) $\frac{1}{5}$ or $\frac{1}{2}$ (E) $\frac{2}{5}$ only

15. If $\frac{1}{s} = \frac{2}{t} - \frac{3}{p}$ then $t = \dots$
- (A) $\frac{1}{s}$ (B) $\frac{2sp}{p+3s}$ (C) $\frac{2p}{p+3s}$ (D) $\frac{sp}{p+3s}$ (E) $\frac{2p}{p+3s}$

16. A and D are the y-intercepts and $BC \parallel AD$. The equation of DC is $y = 2x$ and AB is $y = -2x + 24$ and the area of ABCD is 64 sq units. Determine the coordinates of B.



- (A) (-1;26) (B) (-2;28) (C) (2;20) (D) (3;18) (E) (4;16)

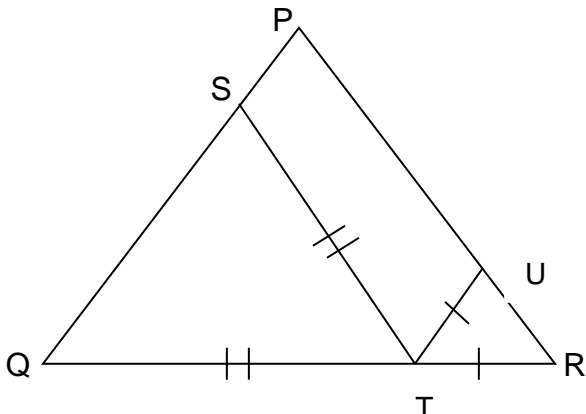
17. Solve for x

$$-5 \leq 3 - 4x \leq 11$$

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

18. In the figure below PQR is a triangle. $ST = QT$; $TU = TR$. $\hat{S}TU = 2x$.

Determine \hat{P} in terms of x



- (A) $90^\circ - 2x$ (B) $90^\circ - x$ (C) x (D) $90^\circ + x$ (E) $3x$

19. An item was marked down by 25% during a sale. One month later the article was marked up by $x\%$ to bring it to its original price. Determine x

- (A) 25 (B) 30 (C) $33\frac{1}{3}$ (D) 35 (E) $35\frac{1}{2}$

20. Three digit numbers are made from the digits 2; 4; 5; 6;7 and 8. How many of these numbers are divisible by 3?

- (A) 54 (B) 48 (C) 42 (D) 36 (E) 30

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

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NON PROFIT MAKING COMPANY
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Grade Eleven Mathematics Olympiad 2017

1. What is the value of $2x^{\frac{2}{3}} = 8; x > 0$

- (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 $a \cdot x \cdot y = \dots$

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

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

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

4. Solve for x

$$(2x^2 + 3x - 2)^2 - (2x^2 + 3x - 2) - 6 = 0$$

- (A) 0;1 only (B) $\frac{-5}{2}; \frac{-3}{2}; 0; 1$ (C) $\frac{5}{2}; \frac{3}{2}$ (D) $\frac{-5}{2}; -1$ (E) $\frac{-5}{2}; \frac{-3}{2}; 2; 1$

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

The value of $a + p$ is

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

6. The equation of the line parallel to $2y = -4x + 3$ and passing through P(-2;1) is...

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

7. Solve for x

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

- (A) $x \leq \frac{1}{2}$ (B) $x > 2$ (C) $\frac{1}{2} \leq x < 2$ (D) $x \leq 0$ or $x > 2$ (E) $x \leq \frac{1}{2}$ or $x > 2$

8. If $xy = -3$ and $\frac{2}{x} + \frac{3}{y} = 4$ then find the value of $9x^2 + 4y^2$

- (A) 96 (B) 84 (C) 72 (D) 180 (E) 24

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

Given $f(x) = \frac{2}{\sqrt{3x}}$ then $g(x) = \dots\dots\dots$

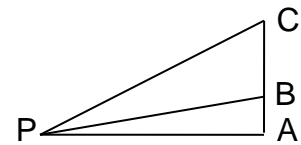
- (A) $\frac{-1}{\sqrt{3x}}$ (B) $\frac{-1}{\sqrt{3x^3}}$ (C) $\frac{2}{\sqrt{3x}}$ (D) $\frac{3}{\sqrt{3x}}$ (E) $\frac{2}{\sqrt{3x^3}}$

10. When simplified to a single ratio

$\frac{2\sin x \cos x + \sin x}{\cos^2 x - \sin^2 x + \cos x + 1}$ is equal to...

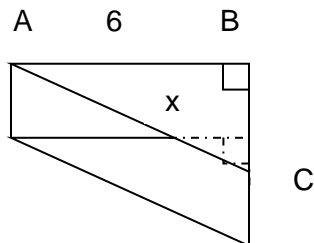
- (A) $\sin x$ (B) $\frac{1}{\cos x - 1}$ (C) $\frac{1}{\tan x}$ (D) $\frac{1}{\sin x - 1}$ (E) $\tan x$

11. A satellite mast is placed 30metres 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 15° and 20° respectively. The length of AP is given by:-



- (A) $\frac{30}{\tan 30^\circ - \tan 15^\circ}$ (B) $\tan 20^\circ - \tan 15^\circ$ (C) $\frac{30 \tan 15^\circ}{\tan 20^\circ}$ (D) $\frac{30}{\tan 20^\circ + \tan 15^\circ}$ (E) $\frac{30 \tan 52^\circ}{\tan 50^\circ}$

12. If the surface area of the right triangular prism with h of 2 cm is 96cm^2 then find 'x'.



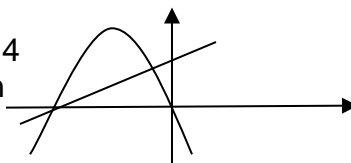
- (A) 7cm (B) 8cm (C) 9cm (D) 10cm (E) 11cm

13. If $a \# b = \frac{2}{a+b}$. Then what is $a \# \frac{1}{b}$

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

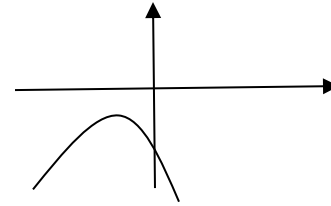
14.

The graph A alongside is defined by $f: y = -x^2 - 4x$ and $g: y = x + 4$ What is the maximum distance between f and g ?



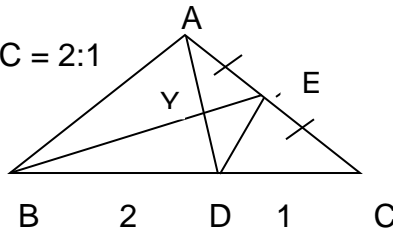
- (A) $\frac{25}{8}$ (B) $\frac{25}{2}$ (C) $\frac{5}{4}$ (D) $\frac{25}{4}$ (E) $\frac{5}{2}$

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) $\frac{b}{2a} > 0$ (C) $c < 0$ (D) $\frac{b}{2a} < 0$ (E) $a < 0$

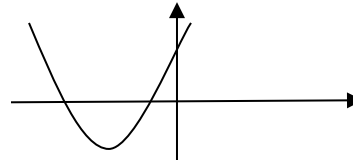
16. BE is a median and $BD:DC = 2:1$
area of $\Delta AYB = 30 \text{ cm}^2$
area of $\Delta EDC = 11 \text{ cm}^2$



The area of $\Delta EYD = \dots$

- (A) 17 cm^2 (B) 14 cm^2 (C) 11 cm^2 (D) 8 cm^2 (E) 3 cm^2

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



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

18. What is the sum of the terms in the 16th bracket? These are all consecutive natural numbers.

(1);(2;3);(4;5;6);(7;8;9;10);.....

- (A) 1112 (B) 1088 (C) 968 (D) 952 (E) 136

19. Car A and Tuk Tuk B travel in opposite directions from towns C and D meet after 90 minutes. Car A travels 30km/h faster than Tuk Tuk B. Car A can cover the total distance in 2 hours. What is the distance between town C and D.

- (A) 108km (B) 102km (C) 96km (D) 90km (E) 84km

20. What is the probability of 3 digit numbers formed from the following numbers are divisible by 11?

2; 3; 5; 6; 8; 9

- (A) $\frac{1}{2}$ (B) $\frac{1}{4}$ (C) $\frac{1}{8}$ (D) $\frac{9}{60}$ (E) $\frac{7}{60}$

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

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

TOTAL: 25