UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

UP MATHEMATICS COMPETITION

Department of Mathematics and Applied Mathematics

Departement Wiskunde en Toegepaste Wiskunde

GRADES 10 AND 11

26 July – 1 Aug 2021

TIME: 2 HOURS

GRADE 10 EN 11

26 July – 1 Aug 2021

TYD: 2 URE

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Leading Minds

Question 1

If $U = \frac{1}{2}$ and $P = \frac{1}{3}$, then $(U+1)(P+3)$ is equal to

Vraag 1

As $U = \frac{1}{2}$ en $P = \frac{1}{3}$, dan is $(U+1)(P+3)$ gelyk aan

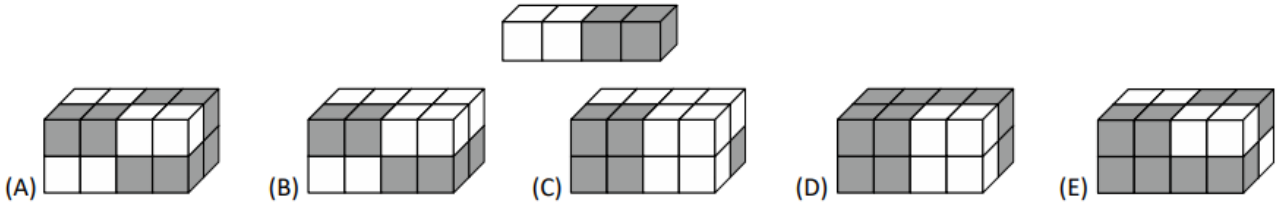
(**A**) 2 (**B**) 3 (**C**) 4 (**D**) 5 (**E**) 6

Question 2

A $4 \times 1 \times 1$ block is made up of 2 white and 2 gray cubes as shown below. Which ONE of the following figure can be build entirely out of such $4 \times 1 \times 1$ blocks?

Vraag 2

'n $4 \times 1 \times 1$ blokkie bestaan uit 2 wit en 2 grys blokkies soos hieronder aangetoon. Watter van die volgende figure kan volledig gebou word uit sulke $4 \times 1 \times 1$ blokkies?



Question 3

Let $f(a,b,c) = 2^{a+b+c} - 2^a - 2^b - 2^c$. Determine $f(1,2,3)$.

Vraag 3

Laat $f(a,b,c) = 2^{a+b+c} - 2^a - 2^b - 2^c$. Bepaal $f(1,2,3)$.

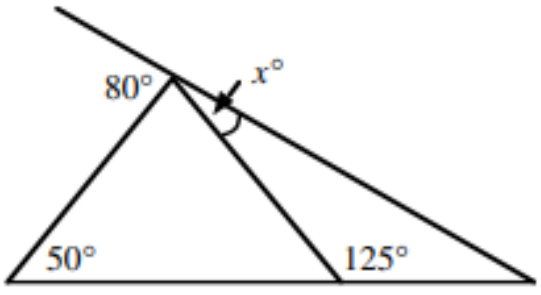
(**A**) 0 (**B**) 48 (**C**) 50 (**D**) 52 (**E**) 54

Question 4

The value of x is

Vraag 4

Die waarde van x is



(**A**) 20 (**B**) 25 (**C**) 30 (**D**) 35 (**E**) None of these/Geen van hierdie

Question 5

Make p the subject of the formula if $q = \dfrac{2p-4}{3p+1}$.

Vraag 5

Maak p die onderwerp van die formule as $q = \dfrac{2p-4}{3p+1}$.

(**A**) $p = \frac{2-3q}{q+4}$ (**B**) $p = \frac{2q-4}{3q+1}$ (**C**) $p = \frac{3q+1}{2q-4}$ (**D**) $p = \frac{4q+1}{3-2q}$ (**E**) $p = \frac{q+4}{2-3q}$

Question 6

Jack leaves Pretoria driving at a speed of $90\,km/h$. Twenty minutes later Jill leaves from the same place travelling the same road as Jack. She catches Jack after 30 minutes. How fast was Jill driving?

Vraag 6

Jack verlaat Pretoria teen 'n spoed van $90\,km/h$. Na twintig minute vertrek Jill vanaf dieselfde plek langs dieselfde pad as Jack. As sy Jack na 30 minute inhaal, hoe vinnig het Jill bestuur?

(**A**) $120\,km/h$ (**B**) $135\,km/h$ (**C**) $150\,km/h$ (**D**) $160\,km/h$ (**E**) $180\,km/h$

Question 7

Suppose for any real number x that $f(x-5) = 6x+7$. What is $f(x+5)$?

Vraag 7

Vir enige reële getal x is $f(x-5) = 6x+7$. Wat is $f(x+5)$?

(**A**) $6x+67$ (**B**) $6x+76$ (**C**) $6x+66$ (**D**) $6x+77$ (**E**) $6x+70$

Question 8

A quadrilateral in the Cartesian plane, has vertices $(0,2), (5,4), (6,1), (3,0)$ in clockwise order. What is the area of this quadrilateral?

Vraag 8

'n Vierhoek in die Cartesiese vlak het hoekpunte $(0,2), (5,4), (6,1), (3,0)$ in kloksgewyse order. Wat is die oppervlakte van die vierhoek?

(**A**) 10 (**B**) 11 (**C**) 12 (**D**) 13 (**E**) 14

Question 9

In which ONE of the following arithmetic progressions does the number 2021 appear?

Vraag 9

In watter EEN van die volgende rekenkundige rye verskyn die getal 2021?

(A) 7,20,33,...

(B) 8,19,30,...

(C) 9,16,23,...

(D) 10,16,22,...

(E) 11,19,27,...

Question 10

How many positive integers n are there with the property that $n/3$ as well as $3n$ are three-digit whole numbers?

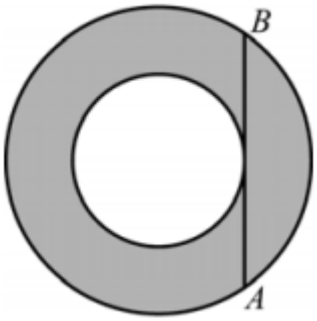
(**A**) 31 (**B**) 32 (**C**) 33 (**D**) 34 (**E**) 35

Vraag 10

Hoeveel positiewe heelgetalle n is daar sodat $n/3$ en $3n$ albei drie-syfer heelgetalle is?

Question 11

The chord AB touches the smaller of the two concentric circles. The length $AB = 12$. How big is the area of the grey part?



(**A**) 12π (**B**) 24π (**C**) 36π (**D**) 144π (**E**) None of these/Geen van hierdie

Vraag 11

Die koord AB raak die kleinste van die twee konsentriese sirkels. Die lengte $AB = 12$. Hoe groot is die oppervlakte van die grys gedeelte?

Question 12

If $2^x = 3$ and $3^y = 32$, then xy equals

(**A**) 5 (**B**) $\log_2 3 + \log_3 32$ (**C**) 6 (**D**) 8 (**E**) $\sqrt{35}$

Vraag 12

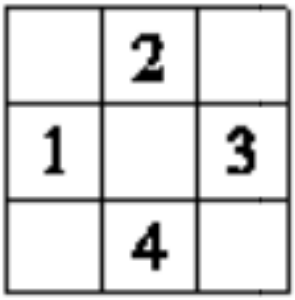
As $2^x = 3$ en $3^y = 32$, dan is xy gelyk aan

Question 13

Thabo wants to write whole numbers into the empty fields of the 3×3 grid below so that the sum of the numbers in each 2×2 square equals 10. Four numbers have already been written down. Which of the following values could be the sum of the remaining five?

Vraag 13

Thabo skryf heelgetalle in die leë spasies van die 3×3 blokkie hieronder, sodat the som van die getalle in elke 2×2 blokkie gelyk is aan 10. Vier van die getalle is alreeds ingevul. Watter van die volgende waardes kan die som van die oorblywende vyf wees?



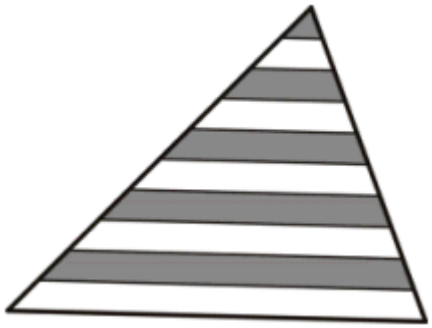
(**A**) 9 (**B**) 10 (**C**) 12 (**D**) 13 (**E**) None of these/Geen van hierdie

Question 14

Lines drawn parallel to the base of the triangle below separate the other two sides into 10 equal parts. What percentage of the triangle is grey?

Vraag 14

Lyne parallel aan die basis van die driehoek verdeel die ander twee sye in 10 gelyke dele. Watter persentasie van die driehoek is grys?



(**A**) 42.5% (**B**) 45% (**C**) 46% (**D**) 47.5% (**E**) 50%

Question 15

Four couples (consisting of four wifes and four husbands) are standing randomly in a row for a photograph. What are the chances that all wives are standing next to their husband?

(**A**) $\frac{1}{16}$ (**B**) $\frac{1}{120}$ (**C**) $\frac{1}{240}$ (**D**) $\frac{1}{210}$ (**E**) $\frac{1}{105}$

Vraag 15

Vier paartjies (bestaande uit vier vroue en vier mans) staan willekeurig in 'n ry vir 'n fotograaf. Wat is die kans dat elke vrou langs haar eie man sal staan?

Question 16

Solve for x if $x^2 + \sqrt{x^2 + x} + x = 6$.

(**A**) $\frac{-1\pm\sqrt{6}}{2}$ (**B**) $\frac{-1\pm\sqrt{37}}{2}$ (**C**) $\frac{-1\pm\sqrt{12}}{2}$ (**D**) $\frac{-1\pm\sqrt{5}}{2}$ (**E**) $\frac{-1\pm\sqrt{17}}{2}$

Vraag 16

Los op vir x as $x^2 + \sqrt{x^2 + x} + x = 6$.

Question 17

100 athletes take part in a race where no one can tie. Everybody is questioned after the race as to which place they ended and all answer with a number between 1 and 100. The sum of all answers is 4000. What is the minimum number of people who have lied about their result?

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

Vraag 17

100 atlete deel aan 'n wedren, waar niemand gelykop kan eindig nie. Na die kompetisie word elkeen gevra in watter posisie hulle geëindig het en elkeen beantwoord met 'n heelgetal van 1 tot 100. Die som van al die getalle is 4000. Wat is die kleinste aantal mense wat gejok het oor hulle posisie?

Question 18

In a class of 100 students, 90 are studying English, 80 are studying Xhosa, 70 are studying Zulu, and 60 are studying Venda. No student is studying all four languages. What is the number of students who are studying both English and Xhosa?

(**A**) 60 (**B**) 65 (**C**) 70 (**D**) 75 (**E**) None of these/Geen van hierdie

Vraag 18

In 'n klas van 100 studente, studeer 90 Engels, 80 Xhosa, 70 Zulu en 60 Venda. Geen student studeer al vier die tale nie. Wat is die aantal studente wat beide Engels en Xhosa studeer?

Question 19

Define the function $R(n)$ that reverses the digits of n and $S(n)$ that adds all the digits of n. For example, $R(435) = 534$ and $S(435) = 4 + 3 + 5 = 12$. Suppose n is a four-digit number such that $R(n) + S(n) = 2021$. If x is the biggest solution and y the smallest solution, determine $x - y$.

(**A**) 2989 (**B**) 2988 (**C**) 2889 (**D**) 2788 (**E**) None of these/Geen van hierdie

Vraag 19

Laat $R(n)$ die getal wees wat die syfers van n omdraai en $S(n)$ die som van die syfers van n is. Byvoorbeeld, $R(435) = 534$ en $S(435) = 4+3+5 = 12$. Laat n 'n vier-syfer getal wees sodat $R(n)+S(n) = 2021$. As x die grootste oplossing is en y die kleinste oplossing, bepaal $x - y$.

Question 20

A point X inside a square ABCD has $AX = 5, BX = 2\sqrt{2}$ and $CX = 3$. What is the area of the square?

Vraag 20

'n Punt X is binne vierkant $ABCD$ met $AX = 5, BX = 2\sqrt{2}$ en $CX = 3$. Wat is die oppervlakte van die vierkant?

(**A**) 15 (**B**) 17 (**C**) 19 (**D**) 29 (**E**) 31