THE WINNING EDGE DEFENCE ACADEMY (WEDA)

RIMC – MOCK PAPER SERIES – 1

SUBJECT: MATHEMATICS – ANSWERKEY

MM: 200 **TIME: 1Hr 30 Min**

Instructions:

1. Attempt all 20 questions. Write answers separately on the answersheet provided at the exam centre.
2. Part 'A' contains 10 questions and each question in this part carries 'Eight marks'.
3. Part 'B' contains 10 questions and each question in this part carries 'Twelve marks'.
4. Use of calculator is prohibited. Complete written justification is required for each question. Marks will be awarded for correct stepsto reach the solution. Answers without justification will not have any credit.
5. Take the value of π as $\frac{22}{7}$
6. Use blue/black ball pen to answer the questions.
7. The question paper can be retained by the candidates post examination.

PART A (10 X 8 = 80 MARKS) (EACH QUESTION CARRIES 8 MARKS)

1. $\frac{20092008^2}{20092007^2+20092009^2-2}$ **=.....**

Explanation: $= \frac{20092008^2}{(20092007^2-1)+(20092009^2-1)}$

$= \frac{20092008^2}{(20092006)(20092008)+(20092008)(20092010)}$

$= \frac{20092008^2}{(20092008)(20092006+20092010)}$

$= \frac{20092008^2}{2(20092008)^2} = \frac{1}{2}$

2. For any real numbers a, b and c, find the smallest possible values thatthe following expression can take:

$3a^2 + 27b^2 + 5c^2 - 18ab - 30c + 237$

Explanation: By completing squares,

$3a^2 + 27b^2 + 5c^2 - 18ab - 30c + 237$

$= (3a^2 - 18\,ab + 27b^2) + (5c^2 - 30c + 45) + 192$

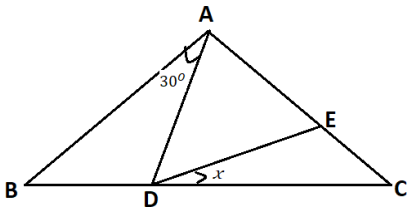
$= 3(a^2 - 6\,ab + 9b^2) + 5(c^2 - 6c + 9) + 192$

$= 3(a - 3b)^2 + 5(c - 3)^2 + 192$

$= \geq 192$

The value 192 is obtained when a = 3b, c = 3. Thus, the smallestpossible value of the given expression is 192.

3. In the figure below AB = AC, ∠BAD = 30^o, and AE = AD. Then, ∠CDE equals:



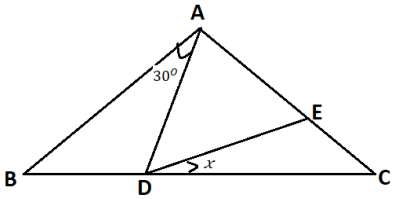
Explanation: Let ∠CDE =x, then

$x = \angle ADC - \angle ADE = \angle ADC - \angle AED$

$= \angle ADC - (X + \angle C),$

$\therefore x = \frac{1}{2}(\angle ADC - \angle C)$

$= \frac{1}{2}(\angle B + 30^o - \angle C) = 15^o$



4. How many of the five numbers are multiples of 10?

a) $2^{100} + 2^{102}$ b) $3^{100} + 3^{102}$ c) $5^{100} - 5^{99}$ d) $6^{100} + 4$ e) $9^{101} + 1$

Explanation: a) $2^{100} + 2^{102} = 2^{100}(1 + 2^2) = 2^{100} \times 5$

∴ yes, $2^{100} + 2^{102}$ is multiple of 10.

b) $3^{100} + 3^{102} = 3^{100}(1 + 3^2) = 3^{100} \times 10$

∴ yes, $3^{100} + 3^{102}$ is multiple of 10.

c) $5^{100} - 5^{99} = 5^{99}(5 - 1) = 5^{99} \times 4$

∴ yes, $5^{100} - 5^{99}$ is multiple of 10.

d) $6^{100} + 4 = 6^{100} + 2^2 = 6 + 4 = 10$

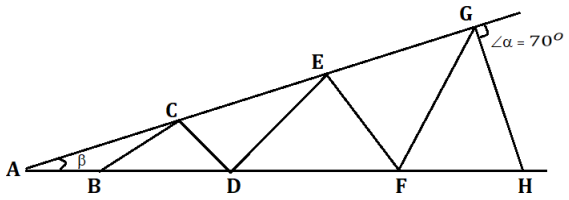
∴ yes, $6^{100} + 4$ is multiple of 10.

e) $9^{101} + 1 = (3^2)^{101} + 1 = 3^{202} + 1$

∴ yes, $9^{101} + 1$ is multiple of 10.

5. As shown in the figure, AB = BC = CD = DE = EF = FG = GH,

∠α = 70^o. Find the Size of ∠β in degrees



Explanation: $\angle A = \beta \Rightarrow \angle ACB = \beta \Rightarrow \angle CBD = 2\beta \Rightarrow \angle CDB = 2\beta$

$\Rightarrow \angle ECD = 3\beta \Rightarrow \angle CED = 3\beta \Rightarrow \angle EDF = 4\beta \Rightarrow \angle EFD = 4\beta$

$\Rightarrow \angle GEF = 5\beta \Rightarrow \angle EGF = 5\beta \Rightarrow \angle GFH = 6\beta \Rightarrow \angle GHF = 6\beta$

$\Rightarrow \angle\alpha = 7\beta$

$\therefore \beta = 10^o$

6. There are four statements about the natural number A:

a) A is divisible by 5

b) A is divisible by 11

c) A is divisible by 55

d) A is less than 10

It is known that two of these statements are true and the other two are false. Then A is equal to:

Explanation: **Case I**

So, statement (a) is correct – '**A is divisible by 5'**

Let us also assume sentence (b) be correct.
Now statement (c) will also be correct which will make thisassumption wrong.

Now let us take statement (d) as a true statement. Then,

(a) and (c) will be wrong. Now **'A is less than 10'** so 'A' will be

Case II

Now if we have assumed statement (b) be true we have ultimately concluded that statement (d) is false. So, now oneof statement (a) or (c) will be correct but it can't happen as both will be correct.

Case III

'A is divisible by 55' but it will now be divisible by both 5 and11 make three statements correct which can't happen.

Case IV

Now let us assume statement (d) which will ultimately makestatement (b) and (c) wrong. So, statement (a) is true and the number 5 as it is natural number.

7. A triathlon consists of running swimming and biking. Biking is half oftotal distance another one third is swimming and the rest 5 miles is running. Find the total distance?

Explanation: Let the total distance be (x) km

Now, Biking = $\frac{x}{2}$ km

Swimming = $\frac{x}{3}$ km

Running = 5 miles

$\frac{x}{2} + \frac{x}{3} + \frac{5}{1} = x$

$\frac{3x+2x+30}{6} = x \Rightarrow 5x + 30 = 6x$

$\Rightarrow 30 = x$

8. Each day a man meets his wife at the railway station after work, and then she drives him home. She always arrives exactly on time to pick himup. One day he catches an earlier train and arrives at the station an hour early. He immediately begins walking home along the same route the wifedrives. Eventually his wife sees him on her way to the station and drives him the rest of the way home. When they arrive home the man notice thatthey arrived 20 minutes earlier than usual. How much time did the man spend walking?

Explanation: Everyday:

At 4 pm wife leaves home and drives to the station.

At 5 pm wife and husband's train both arrive at station.

At 6 pm husband and wife arrive at home.

$\Rightarrow$ Everyday driving time in each direction = 60 minutes.

Today:

Wife and Husband arrive home 20 minutes early. Wife must drive10 fewer minutes in each direction, $\Rightarrow$ she meets her husband after driving 50 minutes from home instead of 60 minutes.

She leaves at 4 pm, she picks up her husband at 4:50 pm. Husband arrives at station one hour earlier than usual.

He arrives at the station at 4 pm instead of 5 pm.

Husband arrives at station at 4 pm and picked up by wife at 4:50pm.

He must be walked for 50 minutes.

9. Andy, Betty, Cathie, Dannie and Eddy were born on 20/ 02/ 2001, 12/03/ 2000, 20/ 03/ 2001, 12/ 04/ 2000 and 23/ 04/ 2001 (day/ month/ year). Andy and Eddy were born in the same month. Also, Betty and Cathiewere born in the same month. Andy and Cathie were born on the same dayof different months. Also, Dannie and Eddy were born on the same day of different months. Which of these children is the youngest?

Explanation: Andy and Eddy were born in same month which means Addy and Eddy must have born either in March or April Betty and Cathie must have born either in March or AprilWhich means in February Dannie was born.

So, date of birth of Dannie will be

= 20/ 02/ 2001

Andy and Cathie were born on same day but of different month

Similarly, Dannie and Eddy were born on same day ofdifferent month

So, it means Eddy must have born on 20/ 03/ 2001So, Eddy = 20/ 03/ 2001

Since, Eddy and Andy have common birth monthSo, Andy was born on 12/ 03/ 2000

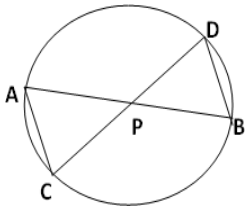
Since, Andy and Cathie have same day.So, Andy was born on 12/ 04/ 2000

Now which gives Betty the date = 23/ 04/ 2001And she is the youngest of all.

10. In Fig., two chords AB and CD intersect each other at the point P. Prove that:

i) Δ APC ~ Δ DPB

ii) AP. PB = CP. DP



Explanation: i) Given: In Δ APC and Δ DPB,

∠APC = ∠DPB …….(Vert. opp. ∠s)

∠CAP = ∠BDP …….(Angles subtended by the same arc of a circleare equal)

∴ By AA – condition of similarity,

Δ APC ~ Δ DPB

ii) Δ APC ~ Δ DPB

So, sides are proportional.

$\Rightarrow \frac{AP}{DP} = \frac{CP}{PB}$

∴ AP × PB = CP × DP

PART B (10 × 12 = 120 MARKS) (EACH QUESTION CARRIES 12 MARKS)

1. Two Kangaroos Jum and Per start to jump at the same time, from thesame point, in the same direction. After that, they make one jump per second. Each of Jum's jumps is 6 m in length. Per's first jump is 1 m in length, the second is 2 m, the third is 3 m, the third is 3 m and so on. Afterhow many jumps does Per catch jump?

Explanation:

In 1st jump distance covered:

Jum	Per
6 m	1 m

In 2nd jump distance covered:

Jum	Per
12 m	1 m + 2 m

In 3rd jump distance covered:

Jum	Per
18 m	1 m + 2 m + 3 m = 6 m

In 4th jump distance covered:

Jum	Per
24 m	6 m + 4 m = 10 m

In 5th jump distance covered:

Jum	Per
30 m	10 m + 5 m = 15 m

In 6th jump distance covered:

Jum	Per
36 m	21 m

In 7th jump distance covered:

Jum	Per
42 m	28 m

In 8th jump distance covered:

Jum	Per
48 m	36 m

In 9th jump distance covered:

Jum	Per
54 m	36 m + 9 m = 45 m

In 10th jump distance covered:

Jum	Per
60 m	45 m + 10 m = 55 m

In 11th jump distance covered:

Jum	Per
66 m	55 m + 11 m = 66 m

After 11^{th} jump he will catch.

2. Three persons A, B and C gave these statements:

A said, either Freedom Party or Green Party won the elections.

B said, Freedom Party won.

C said, neither Freedom Party nor Green Party won the elections.

Of these persons, only one person is wrong. Who won the elections?

Explanation: As only one person is wrong,

So, other two persons are telling the truth. Assume that the Freedom Party won the election.

So, the statements of A and B are true as they satisfy our condition that 2 of them are truth tellers.

Hence the Freedom Party wins the election.

If you assume that the Green Party won the election, statements of B and C become false which is violating the given condition.

3. The number 27000001 has exactly four prime factors. Find their sum.

Explanation: Given Number = 27000001

= 27000001 + 1

= $(300)^3 + 1$

Using $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

= $(300 + 1)(300^2 - 300 + 1)$

= $301 \times (300^2 + 2 \times 300 - 2 \times 300 - 300 + 1)$
= $301 \times (300^2 + 2 \times 300 + (1)^2 - 900)$

= $301 \times [(300 + 1)^2 - 900]$

$[(a + b)^2 = a^2 + 2ab + b^2]$

= $301 \times (301 - 30) \times (301 + 30)$

= $301 \times 331 \times 271$

= $7 \times 43 \times 271 \times 331$

$\therefore$ Sum = 7 + 43 + 271 + 331 = 652

4. Rohan keeps a total of 90 guppies in 4 fish tanks.

- **There is 1 more guppy in the 2nd tank than in the 1st tank.**
- **There are 2 more guppies in the 3rd tank than in the 2nd tank.**
- **There are 3 more guppies in the 4th tank than in the 3rd tank.**

How many guppies are in the 4th tank?

Explanation: Let x denote the number of guppies in the first tank.

Then, we have the following for the number of guppies in the rest of the tanks:

- $x + 1 =$ the number of guppies in the second tank
- $x + 1 + 2 =$ the number of guppies in the third tank
- $x + 1 + 2 + 3 =$ the number of guppies in the fourth tank

The number of guppies in all of the tanks combined is 90, so we can write the equation.

$$x + x + 1 + x + 1 + 2 + x + 1 + 2 + 3 = 90$$

Simplifying the equation gives

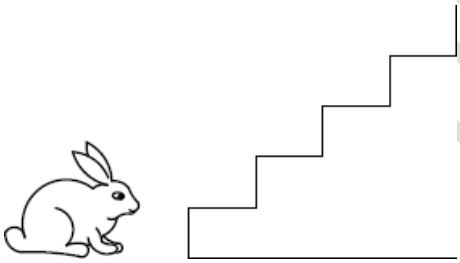
$$4x + 10 = 90$$

Solving the resulting equation gives $x = 20$, so the number of guppies in the fourth tank is

$$20 + 1 + 2 + 3 = 26$$

Therefore, the correct answer is 26.

5. Buzz Bunny is hopping up and down a set of stairs, one step at a time. In how many ways can Buzz start on the ground, make a sequence of 6 hops, and end up back on the ground? (For example, one sequence of hopsis up-up-down-down-up-down.)



Explanation: Looking at the answer choices, you see that you can list them out. Doing this gets you:

$UUDDUD$

$UDUDUD$

$UUUDDD$

$UDUUDD$

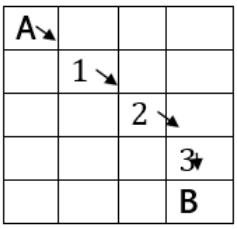
$UUDUDD$

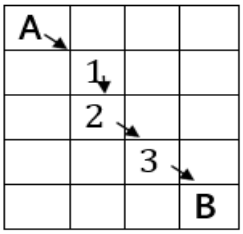
Counting all the paths listed above gets you 5.

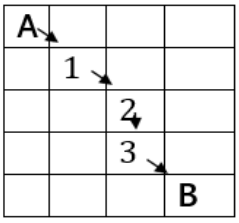
6. How many possible routes with the minimum number of moves arethere for a man to travel from A to B of the grid (man can move to any adjacent square, including diagonally)?

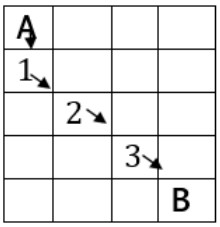
A			
			B

Explanation: Only four ways are there by covering least number of boxes









7. On Monday Taye has $2. Every day, he either gains $3 or doubles theamount of money he had on the previous day. How many different dollaramounts could Taye have on Thursday, 3 days later?

Explanation: How many values could be on the first day? Only 2 dollars. The second day, you can either add 3 dollars, or double, so you can have 5 dollars, or 4. For each of these values, you have 2 values for each. For 5 dollars, you have 10 dollars or 8, and for 4 dollars, you have 8 dollars or $7. Now, you have 2 values for each of these. For 10 dollars, you have 13 dollars or 20, for 8 dollars, you have 16 dollars or 11, for 8 dollars, you have 16 dollars or 11, and for 7 dollars, you have 14 dollars or 10.

On the final day, there are 11, 11, 16, and 16 repeating, leaving you with 8 – 2 = 6 different values.6.

8. The year 2021 is such that the only common factor of 20 and 21 is 1. How many other years from 2001 to now have had this property?

Explanation:

2001

(20, 01) has common factor 1

Even numbers at unit digit is not possible. So,(20, 03)

(20, 05) (20, 13) (20, 23)

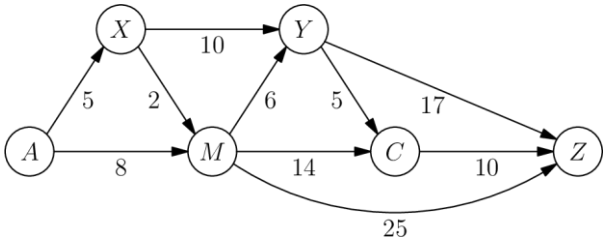
(20, 07) (20, 17)

(20, 09) (20, 19)

(20, 11) (20, 21)

So, these are 10 years which is required.

9. The one-way routes connecting towns A, M, C, X, Y and Z are shownin the figure below (not drawn to scale). The distances in kilometres alongeach route are marked. Traveling along these routes, what is the shortest distance from A to Z in kilometres?



Explanation: We can simply see that path A → X → M → Y → C → Z will give us the smallest value. Adding, 5 + 2 + 6 + 5 + 10 = 28. This is nice as it's also the smallest value, solidifying our answer.

You can also simply brute-force it or sort of think ahead - for example, getting from A to M can be done 2 ways; A → X → M (5 + 2) or A → M (8), so you should take the shorter route (5 + 2). Another example is M to C, two ways - one is 6 + 5 and the other is 14. Take the shorter route. After this, you need to consider a few more times - consider if 5 + 10 (Y → C → Z) is greater than 17(Y → Z) , which it is not, and consider if 25(M → Z) is greater than 14 + 10 (M → C → Z) or 6 + 5 + 10 (M → Y → C → Z) which it is not.
True: 5 + 2 = 6 = 5 = 10 = 28.

Q10. Let the letters F, L, Y, B, U, G represent distinct digits. Suppose F L Y F L Y is the greatest number that satisfies the equation 8. F L Y F L Y = B U G B U G. What is the value of F L Y + B U G?

Explanation: The highest that FLYFLY can would have to be 124124, and it cannot be higher than that because then it would exceed the 6-digit limit set on BUGBUG.
So, if we start at 124124.8, we get 992992, which would be wrong because both B&U would be 9, and the numbers cannot be repeated between different letters.
If we move on to the next lowest 123123, and multiply by 8, we get 984984. All the digits are different, so FLY + BUG would be 123 + 984, which is 1107. So, the answer is 1107.

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