Math 30-2 Diploma Questions Below 50% (2019)

1.

Year	Topic	Outcome	Cognitive Level	Standard	Difficulty
2019	Probability	6	Problem Solving	Acceptable	**45.7%**

A golf shop sells 7 different drivers and 6 different irons. If Susan purchases 3 different drivers and 2 different irons, then the number of different golf club selections she can make is ___525___.

Solution

Think in terms of 2 stages, drivers and irons, and applying the Fundamental Counting Principle.

_____   _____

drivers   irons

Determine the number of options for each stage. For this example, we are looking for how many ways Susan can select 3 drivers from a total of 7, and how many ways she can select 2 irons from a total of 6. Since order is not important, we will be using combinations.

$_7C_3$ $_6C_2$

drivers   irons

Now multiply the number of options available for each stage.

$_7C_3$ X $_6C_2$

drivers   irons

(35)   X   (15)   =   **525**

drivers   irons

<u>Possible Reasons for The Low Percentage of Correct Answers</u>

- A student may have thought that there were only 3 options for drivers and 2 options for drivers. They then either multiplied to get 6, or added to get 5.
- The stages may have been identified correctly, but instead of using combinations, permutations were used.
- The stages may have been identified correctly, and combinations were correctly identified, but the total number of options for each stage was added rather than multiplied.

2.

Year	Topic	Outcome	Cognitive Level	Standard	Difficulty
2019	Probability	5	Problem Solving	Acceptable	**44.5%**

Use the following information to answer the next question.

Finley has 8 game pieces that differ only in colour. Each game piece is either all red or all black. When Finley lines up the 8 game pieces in a single row, there are 28 distinguishable arrangements.

Based on the information above, Finley could have ___i___ red game pieces and ___ii___ black game pieces.

The statement can be completed by the information in row

Row	i	ii
A.	4	4
B.	5	3
C.	6	2
D.	7	1

Solution

This question involves permutations with repetition. The word **arrangement** provides a clue that order is important, which in turn means that our knowledge of permutations will be applied.

The number of distinguishable arrangements can be found using:

$$\frac{n!}{a!\,b!\,c!\,...}$$

The value of n is 8. There are two different types of objects that can possibly be repeated – red and black. Therefore, the denominator will be a!b!.

$$28 = \frac{8!}{a!\,b!}$$

$$a!\,b! = \frac{8!}{28}$$

$$a!\,b! = 1440$$

From the given options, the only row that will give a result of a!b! being equal to 1440 is row C; since 6! X 2! = 1440.

The correct answer is C.

Possible Reasons for The Low Percentage of Correct Answers

- The meaning of the word, *distinguishable,* was unknown. For example, if we were to make a distinction between two red pieces, and call them R_1 and R_2, the following: $R_1R_2BBBBBB$ and $R_2R_1BBBBBB$ are theoretically different when all 8 tiles are arranged with 8!; but it is considered to be only 1 *distinguishable* arrangement.
- The notion of repetition of objects and using the formula:
  number of arrangements = $\frac{n!}{a!b!c!...}$, was not determined.
- It may have been thought to use combinations.
- Incorrect manipulation of the equation, $28 = \frac{8!}{a!b!}$.
- Not understanding that the possible options for (i) and (ii) represent (a) and (b) in the formula.

3.

Year	Topic	Outcome	Cognitive Level	Standard	Difficulty
2019	Relations and Functions	3	Cognitive	Excellence	**43.9%**

Use the following information to answer the next question.

While correctly solving the rational equation $\frac{3x+6}{5} + \frac{5x}{x+2} = 2x$ algebraically, a student wrote an equivalent quadratic equation of the form $ax^2 + bx + c = 0$

The equivalent quadratic equation could have been

A) $2x^2 + 6x - 6 = 0$
B) $3x^2 + 35x + 12 = 0$
C) $7x^2 - 17x - 12 = 0$
D) $10x^2 + 12x - 6 = 0$

Solution

Clear the fraction by multiplying each of the 3 terms by the least common denominator (LCD). Given the denominators of (5) and (x + 2), their product will be the LCD.

$$(5)(x+2)\left[\frac{3x+6}{5}+\frac{5x}{x+2}=2x\right]$$

[(x + 2) (3x + 6)]   +   [(5) (5x)]   =   (5)(x + 2) (2x)

$3x^2$ + 12x + 12   +   25x   = $10x^2$ + 20x

$0 = 7x^2 - 17x - 12$

Possible Reasons for The Low Percentage of Correct Answers

- Didn't think of or didn't know how to clear fractions.
- Weak algebraic skills of multiplying binomials and combining like terms.

4.

Year	Topic	Outcome	Cognitive Level	Standard	Difficulty
2019	Relations and Functions	7	Cognitive	Acceptable	**42.2%**

The graph of the cubic function of the form y = ax^3 + bx^2 + cx + d, where a < 0 and

d > 0, extends from Quadrant _i_ to Quadrant _ii_ and the sign of the y-intercept is _iii_.

The statement above is completed by the information in row

Row	i	ii	iii
A.	2	4	positive
B.	2	4	negative
C.	3	1	positive
D.	3	1	negative

The leading coefficient is represented by the value of 'a'. Since 'a' is less than zero, or negative, the graph extends from quadrant 2 to quadrant 4.

Given the fact that 'd' is greater than zero, or positive, the y-intercept must be positive. Substituting zero for x, $y = a(0)^3 + b(0)^2 + c(0) + d$, we will see that the y-intercept is

$y = d$.

The correct answer is A.

Possible Reasons for The Low Percentage of Correct Answers

- A lack of understanding how the leading coefficient affects the graph. Moving left to right on the graph, a positive leading coefficient for a cubic function extends down into quadrant 3 and up into quadrant 1. A negative leading coefficient for the same graph extends up into quadrant 2 and down into quadrant 4.
- Not knowing, or remembering, that for all y-intercepts, the value of x is 0. Substituting x = 0 into the equation, will yield the y-intercept. In the given form of the equation, the value of 'd' is the y-intercept. The question tells us that d > 0, or positive.

5.

Year	Topic	Outcome	Cognitive Level	Standard	Difficulty
2019	Relations and Functions	8	Cognitive	Excellence	**43.6%**

A Ferris wheel at a local fair has a diameter of 68 m and the maximum height above the ground reached by a seat is 74 m.

When discussing the graph of a sinusoidal function that models the height of the seat above the ground during the ride, six students made the following statements.

Statement 1	The median value is 34 m.
Statement 2	The median value is 40 m.
Statement 3	The minimum value is 0 m.
Statement 4	The minimum value is 6 m.
Statement 5	The amplitude is 34 m.
Statement 6	The amplitude is 68 m.

The three statements above that are true are numbered

A) 1, 4, and 5
B) 1, 3, and 6
C) 2, 4, and 6
D) 2, 4, and 5

Solution

Diameter of 68 m

6 m

Ground
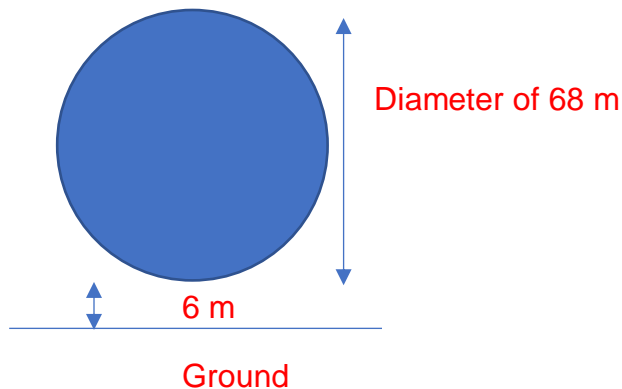
The maximum height is 74 m (68 + 6) and the minimum height is 6 m.

$$amplitude = \frac{maximum\ value - minimum\ value}{2}$$

$$amplitude = \frac{74 - 6}{2}$$

Amplitude = 34

$$median = \frac{maximum\ value + minimum\ value}{2}$$

$$median = \frac{74 + 6}{2}$$

Median = 40

Statements 2, 4, and 5 are correct.

The correct answer is D.

Possible Reasons for The Low Percentage of Correct Answers

- Not knowing the meaning of median or amplitude.
- Not knowing that the minimum value is the difference between the maximum height and the diameter.
- Unable to remember and apply

$$amplitude = \frac{maximum\ value - minimum\ value}{2}$$

$$median = \frac{maximum\ value + minimum\ value}{2}$$