Name: _____

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Multiple Choice (50 Marks)

Place all answers in the multiple choice boxes on the front page of the answer booklet.

Questions 1-10 below are worth:

3 marks for a correct answer
1 mark for a blank answer
0 marks for an incorrect answer.

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(1) What is the sum of the digits of $(10^k + 1)^2$ where $k = n^2 + 2n + 15$?

(A) $2n$ (B) 15 (C) 4 (D) 2 (E) n^2

(2) For what value of a does the system of equations $3x + 7y = 5$ and $x + ay = 2$ have no solutions in real numbers x and y?

(A) 2/7 (B) 5/2 (C) 1/2 (D) 7/3 (E) 3/7

(3) What is the value of the square of $3^{\sqrt{3}}$?

(A) 1 (B) $9^{\sqrt{3}}$ (C) 9 (D) 27 (E) 3

(4) What is the value of

$$(1 - 1/2) + (1/2 - 1/3) + (1/3 - 1/4) + \cdots + (1/100 - 1/101)?$$

(A) 99/100 (B) 99/101 (C) 1/101 (D) 100/101 (E) 101/100

(5) If $\sqrt{4 + \sqrt{x}} = 3$, then x is

(A) 19 (B) 6 (C) $\sqrt{5}$ (D) 25 (E) 3

(6) Which of the numbers in the list: 5, 1, 1/10, 1/20, 1/40 is the largest member of the list that is smaller than $\sqrt{10020} - \sqrt{10010}$?

(A) 5 (B) 1 (C) 1/10 (D) 1/20 (E) 1/40

(7) The average age of a group consisting of mathematicians and physicists is forty. The average age of the mathematicians is thirty-five, and the average age of the physicists is fifty. What is the ratio of the number of mathematicians to the number of physicists?

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

(8) Citizens of Laputa are taxed on the following system. If they earn n shekels, they pay n percent of their salary in tax. What is the best salary to have in Laputa?

(A) 33 (B) 42 (C) 50 (D) 60 (E) 64

(9) A circle passes through the points $(0, 6)$, $(0, 10)$, and $(8, 0)$. What is the x-coordinate of the centre?

(A) 27/4 (B) 29/4 (C) 15/2 (D) 31/4 (E) 33/4

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(10) A professor tries grouping the students in his class for an assignment. When he groups them in threes, he has two left over. When he groups them by fives, he has two left over. When he groups them in sevens, he has five left over. Assuming he has fewer than sixty students, how many does he have?

(A) 26 (B) 47 (C) 58 (D) 51 (E) 32

Questions 11-15 below are worth:

4 marks for a correct answer
1 mark for a blank answer
0 marks for an incorrect answer.

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(11) A standard deck of cards contains fifty-two cards, four of each rank. How many possible five card hands are there that contain four cards of the same rank? (Note: order does not matter.)

(A) 526 (B) 676 (C) 624 (D) 48 (E) 13

(12) Before getting married, a man lived in Thunder Bay, then Dryden, and then Kenora. After he got married, he spent the rest of his life in Fort Frances. One seventh of his life was spent in Thunder Bay, one sixth was spent in Dryden, and one twelfth in Fort Frances. Five years after he got married, his son was born. The son died four years before the father, and the son's age when he died was half the father's age when the father died. How many years did the father live?

(A) 56 (B) 62 (C) 76 (D) 84 (E) 95

(13) The pages of a book are numbered starting with 1. We add up the page numbers, but include one page twice. If the sum we got was 130, what was the page number that we included twice?

(A) 12 (B) 10 (C) 15 (D) 7 (E) 20

(14) What is the area of the region of the plane determined by the inequality $2 \leq |x| + |y| \leq 3$?

(A) $\sqrt{2}$ (B) 8 (C) 10 (D) 18 (E) 5/2

(15) Consider the right triangle drawn below. Find a.

(A) 24/5 (B) 5 (C) 7 (D) $\sqrt{10}$ (E) impossible to determine

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Full Solutions (50 Marks)

Place your solutions to these questions in the space provided. Each question is worth 10 marks.

You must show sufficient work to receive full marks, but if you do not completely answer a question you may still receive partial marks for showing work. So **show your work!**

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1. Four suspects, exactly one of whom has committed a crime, made the following statements. If exactly one is telling the truth, who committed the crime?

Anne said, "Bob is guilty."
Bob said, "Donald is guilty."
Karol said, "I'm innocent."
Donald said, "Bob is lying."

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2. Three students buy three bags of jelly beans. One bag cost $ 4.55, the second cost $ 1.54, and the third cost $ 1.10. Assuming the cost of a single jelly bean is a whole number multiple of a penny, what is it?

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3. We are inflating a balloon which remains a sphere however large we inflate it. At one point, we measure the circumference of the sphere. Then we inflate it a bit more, and measure again. When we do this, we find that the circumference has increased by 1 cm. How much has the radius of the balloon increased?

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4. While canoeing up the Kam river at constant speed v relative to the water, John loses his hat as he passes under the bridge. Later, he notices the loss and turns the canoe downstream to recover the hat, which takes him 20 minutes at the same speed (relative to the water). When he recovers the hat, he is one kilometre downstream of the bridge. What is the speed of the current of the Kam?

Name: _____

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5. A trash can contains 357 red balls and 284 green balls. Next to the trash can we have a large pile of green balls. We draw two balls at random from the trash can. If both of the balls are green, we put one back in and throw the other one away. If both are red, then we throw both of them away, and add a green ball from the pile. If one is red and the other is green, we put the red one back into the trash can and throw the green one away. We repeat this procedure until only one ball is left in the trash can. What colour is this last ball?