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**Intermediate Division**

**Grades 9 and 10**

**Contest Instructions and Information:**

**Part I: Individual Contest**

1. The IMOYA Contest has 3 Sections:

 Section A is composed of 5 calculations skills items.

 Section B is composed of 5 perk-ups problem items.

 Section C is composed of 5 challenging problem items.

2. Enter the letter of the correct answer on the space provided for each number.

3. Diagrams are NOT drawn to scale

4. No calculator, calculating device or protractor is allowed.

5. Time limit: 90 minutes

**SECTION A. Calculation Skill Problems**

*Compute each of the following using a simple method. Each correct answer worth 4 points. Total of 20 points.*

1. Let  what is the value of 

 A. 2000 B. 2010 C. 2020 D. 2050

**Suggested Solution:**

 

 The answer is D.

2. It is known that and  Find the numerical value of 

 A. 10 B. 8 C. 6 D. 4

**Suggested Solution:**

 From  we have  If one of  is correct, then  it follows when the possible values are 

 Therefore, 

 The answer is D.

3. Find the simplified value of  in exponential form.

 A.  B.  C.  D. 

**Suggested Solution:**

 The answer is A.

 

4. If  and *abc* ≠ 0, then find the value of *c*.

 A.  B.  C.  D. 

**Suggested Solution:**

 To isolate *c*, multiply both sides of the equation by 

 

 The answer is B.

5. Factor completely: 

 A.  B. 

 C.  D. 

**Suggested Solution:**

 The answer is B.

 

**SECTION B. Simple Problems**

*Select the correct answer in each problem. Each problem is worth 5 points, for a total of 30 points.*

1. If *k* is a constant such that the quadratic equation  has equal roots, then what is the value of *k*?

 A.  B.  C.  D. 

**Suggested Solution:**

 The answer is C.

 As  has equal roots, the discriminant is zero.

 

2. Which of the following statements about the triangles in the figure must be true?

 A. I and II are similar B. I and III are similar

 C. II and IV are similar D. III and IV are similar

**Suggested Solution:**

 The answer is B.

 *a* + *b* + 90° = 180° (∠sum of △)

 *b* = 90° – *a*

 *a* + 90° + *c* = 180° (Adj. ∠s on st.line)

 *c =* 90° – *a*

 then *b* = *c*

 *c* + d + 90° = 180° (∠ sum of △)

so that *d* = 90° – *c* = 90° – (90° – *a*) = *a*

 Hence, I and III are similar. (*A.A.A.*)

3. If then what is the value of *x*?

 A.  B.  C. 2 D. 

**Suggested Solution:**

 Rewrite the equation so that the same base is on both sides.

 

 The answer is C.

4. As shown in the figure, in the square *ABCD*, *E* is on , , , and *P* is on *BD*, find the minimum value of the sum of the lengths of *PE* and *PC*.

 A.  B.  C.  D. 

**Suggested Solution:**

Because *ABCD* is a square, *A* and *C* are symmetrical points about the line where  is located, connecting , and  is known by symmetry , the minimum value of  is the minimum value of , and the minimum value of  is the line segment *AE*. In , 

5. As shown in the figure, there are five points *A, B, C, D* and *E* on the number line where coordinate of each point is an integer and  If the coordinates of point *A* and *E* are –13 and 12 respectively. Among the five points on the number line, what is the coordinate of the point that is nearest to the midpoint of 



 A. –2 B. –1 C. 0 D. 2

**Suggested Answer:**

The answer is B.

**SECTION C. Challenging Problems**

*Solve each word problem. Simplified Solution of each problem is a must and it worth 10 points for a total of 50 points.*

1. If  represent a four-digit number and . For example, 1331, 7557, then  is called a symmetric number. Now arrange all the four-digit numbers from the smallest to the largest. Which of the following is the 12th four-digit symmetric number?

 A. 2442 B. 2112 C. 2332 D. 2222

**Suggested Solution:**

When arrange all the four-digit numbers from the smallest to the largest, we must consider *a* = *d* = 1 and the *b* = *c*. We have 0 to 9 to fill in. So the first 10 four-digit symmetric number are 1001, 1111, 1221, ⋅⋅⋅, 1991. Now let *a* = *d* = 2 and we have *b* = *c*, the value must be from 0 to 9 again, so we have 2002, 2112.

The answer is B.

 2. When . Which of the following expression will yield the maximum value?

 A.  B.  C.  D. 

**Suggested Solution:**

 Consider 

 

 and .

 Therefore, A is the largest.

 The answer is A.

3. A vegetable store receives a shipment of 9 dozen heads of lettuce. The store sells  of the lettuce in the first two hours and 2 dozen more later in the day. How many dozen heads of lettuce remain at the end of the day?

 A. 48 B. 4. C. 3 D. 1

**Suggested Solution:**

First, determine the total number sold that day.

 Total sold  of 9 dozen + 2 dozen

  dozen + 2 dozen

 = 6 dozen + 2 dozen

 = 8 dozen

 Then, subtract to determine how many are left.

 9 dozen – 8 dozen = 1 dozen

 The answer is D.

4. If  then what is the numerical value of 

 A.  B.  C. 5 D. 6

**Suggested Solution:**

 Let 

 Then and then 

 Multiply (1) and (2), we have 

 Then 

 So the original expression = 

 The answer is A.

5. As shown in the figure, there are 3 squares *a*, *b*, *c* lie on the straight line. If the area of *a* and *c* are 5 square units and 11 square units. What is the area of square *b*?

 A. 4 B. 6

 C. 16 D. 55

**Suggested Solution:**

 The answer is C.