

# Sierra Economics and Science Foundation

Home of TechTest – Where the elite compete



## Welcome to TechTest Jr. 2014

**\*\*\*\* Please do not begin your test or view any questions until instructed to do so. \*\*\*\***

### **Test Taking Information and Instructions:**

Welcome to TechTest Jr. 2014 and thank you for participating. TechTest Jr is a middle school version of TechTest, which is offered to high school juniors and seniors and includes significant scholarship money based on the test results.

You will not be allowed to bring in any paper or pencils with you. Pencils and scratch paper will be provided. If you need additional paper or pencils, you may raise your hand to call a proctor for assistance. If you have any questions, you may also raise your hand for assistance. However, the proctors can only provide clarification. They cannot assist you in figuring out a question.

You have up to two hours to complete the exam. After completing it, you will need to turn in your exam, answer sheet and pencil(s). At that point, you are welcome to wait in an adjoining classroom or tour the Nevada Union science labs while the remaining participants complete their exams and all exams have been graded. Awards will be given to the top finishers. All exams will be graded on-site and the winners will be announced shortly after the end of the last test has been collected.

This year, TechTest Jr. consists of 38 questions, plus a tie-breaker question. The questions include math and science topics typically covered in 7<sup>th</sup> and 8<sup>th</sup> grade classes. All questions are multiple-choice and will be entered on a Scantron form. If you change an answer, be sure to completely erase the original response. Calculators may be used, but if they have memory, the memory must be erased prior to the test. Phones or any other electronic devices will not be allowed in the testing area.

\* If you need a bathroom break during the test, please raise your hand and a proctor will assist you. \*



Name: \_\_\_\_\_

Exam #: \_\_\_\_\_

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Questions 1-6 are worth 1 point each

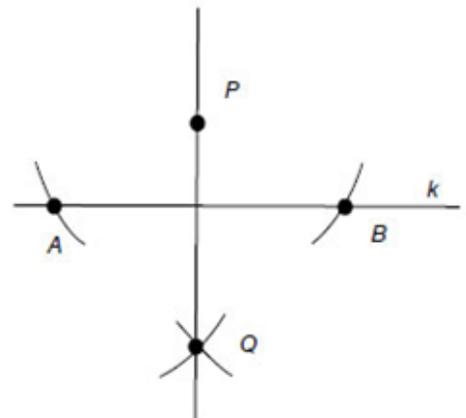
- 1)  $6!$  is equivalent to which of the following?
  - A) 1
  - B) 6
  - C) 21
  - D) 720
  
- 2) Two sides of a triangle have lengths of 17 and 11 inches. Which of the following could not be the length of the third side?
  - A) 8 inches
  - B) 10 inches
  - C) 25 inches
  - D) 29 inches
  
- 3) Solve for X:  $X = 3 + 7 - 2 * 5$ 
  - A) 0
  - B) 28
  - C) 40
  - D) 60
  
- 4) Solve for X:  $X = 3 + (7 - 2) * 5$ 
  - A) 0
  - B) 28
  - C) 40
  - D) 60
  
- 5) Solve for X:  $X = (3 + 7 - 2) * 5$ 
  - A) 0
  - B) 28
  - C) 40
  - D) 60

- 6) Solve for X:  $X = 3 + (7 - 2 * 5)$
- A) 0  
B) 28  
C) 40  
D) 60

Questions 7-18 are worth 2 points each

- 7) Bubba Johnson signed a new, seven-year football contract. He received a total of \$2.35 million dollars. Part of that amount was a \$40,000 signing bonus (a one-time incentive payment) to sign up. How much will his yearly salary be?
- A) \$330,000  
B) \$235,000  
C) \$40,000  
D) \$336,000
- 8) If a coin is flipped 10 times, what is the probability of the last flip ending up as "heads"?
- A) 10%  
B) 20%  
C) 50%  
D) 90%
- 9) Solve for x and y:  
 $3x + 4y = 31$   
 $7x - 31 = y$
- A)  $x=3; y=-10$   
 B)  $x=5; y=4$   
 C)  $x=3; y=-4$   
 D)  $x=4; y=3$
- 10) A box is circumscribed (drawn around it, touching it at the edges but not cutting into it) around a sphere with a radius of 4 inches. What is the volume of the box?
- A) 50 cubic inches  
 B) 64 cubic inches  
 C) 266 cubic inches  
 D) 512 cubic inches
- 11) If you rode your bike from GV to Auburn and averaged 20mph, then rode back from Auburn to GV and averaged 15mph, what would your overall average speed be for the entire round-trip?
- A) 15mph  
 B) 17.1mph  
 C) 17.5mph  
 D) 20mph

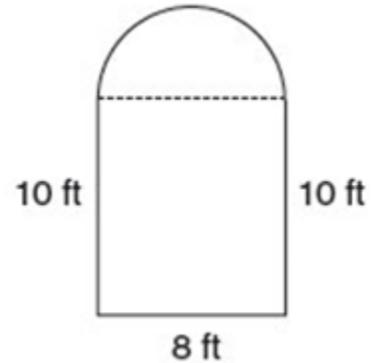
- 12) Using the figure to the right, the compass and straightedge construction shown is which of the following?



- A) Angle bisection  
 B) Segment bisection  
 C) A perpendicular line through a point not on line k  
 D) A perpendicular line through a point on line k

- 13) The window at the right is constructed as a semi-circle attached to the top of a rectangle. Given the dimensions shown, what is the approximate outside perimeter?

- A) 53.1
- B) 40.6
- C) 28.0
- D) 36.0



- 14) It's 7:00am and the current temperature is 17 degrees Fahrenheit. The sun is up and the temperature is rising at a rate of 3 degrees Fahrenheit per hour. At what time will it reach the freezing point?

- A) 10:00am
- B) 12:00pm
- C) 3:00pm
- D) It is already above the freezing point

- 15) A pot of water at sea level is being heated up. It started at 50 degrees Celsius and is heating up at a constant 5 degrees Celsius per minute. How long will it take to reach the boiling point?

- A) 10 minutes
- B) 33 minutes
- C) 50 minutes
- D) It is already above the boiling point

- 16) Solve for Y:  $Y = (|6 - 3| + 7) * |3 - 6|$

- A) -30
- B) 0
- C) 30
- D) 63

- 17) Solve for Y:  $Y = (|6 - (3 + 7)| * 3 - 6)$

- A) -18
- B) 18
- C) 24
- D) 6

- 18) You decided to take a break from your math homework and played some Monopoly. After building up your properties, you had 6 houses and 3 hotels. Unfortunately, you landed on Chance and drew the "General Repairs" card. You now have to pay \$40 for each house and \$115 for each hotel. How much money will it cost you?

- A) \$360
- B) \$585
- C) \$810
- D) \$1035

Questions 19-33 are worth 3 points each

19) If a coin is flipped 3 times in a row, what is the probability of the three flips coming out in the following order: "heads"- "tails"- "heads"?

- A) 10%
- B) 12.5%
- C) 25%
- D) 50%

20) Solve for x, y and z:

$$2x + 4y + 27 = 5z$$

$$4x + 2z = y + 24$$

$$-x - y - z + 6 = 0$$

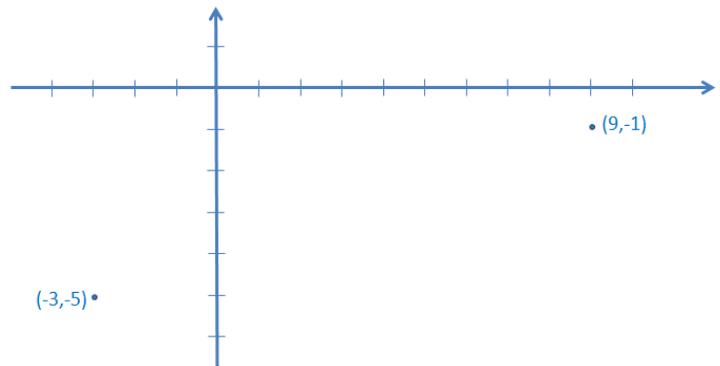
- A)  $x=2; y=4; z=5$
- B)  $x=2; y=2; z=2$
- C)  $x=3; y=-2; z=5$
- D)  $x=3; y=5; z=-2$

21) You walk into a pizza joint and look at the menu. They are running a special in which you can get a pizza and drink for \$5. There are three types of pizza toppings you can choose (sausage, pepperoni, or chicken), two types of crust you can choose (thin or thick) and four types of drink you can choose (Coke, Pepsi, Dr. Pepper or Sprite). How many different combinations of one topping, one crust and one drink can be made?

- A) 9
- B) 9!
- C) 24
- D) 36

22) What is the equation of the line through the two points shown: (-3,-5) and (9,-1)?

- A)  $3y=x-12$
- B)  $y=-1/3(x) - 4$
- C)  $y+1/3(x) =12$
- D)  $y=1/3(x) +4$



23) The speed limit in through Nevada City and Grass Valley used to be 55mph. It is now 60mph. Some citizens protested and said that it would waste gas and would not save a significant amount of time. If it's 6.5 miles from one end of Nevada City to the far side of Grass Valley, how much longer would it take you to drive end to end at 55mph vs. 60 mph?

- A) 5 seconds
- B) 35 seconds
- C) 1 minute
- D) 115 seconds

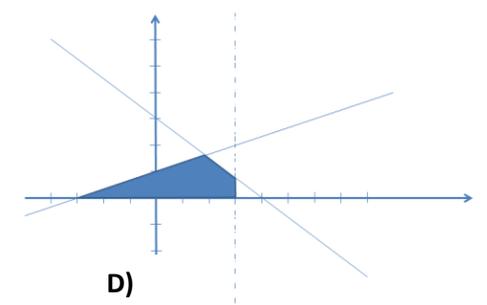
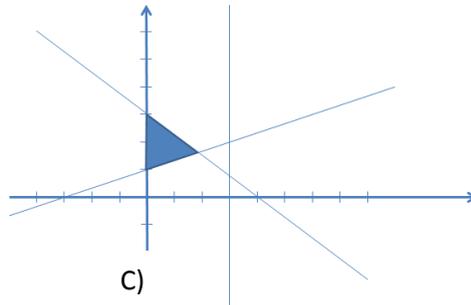
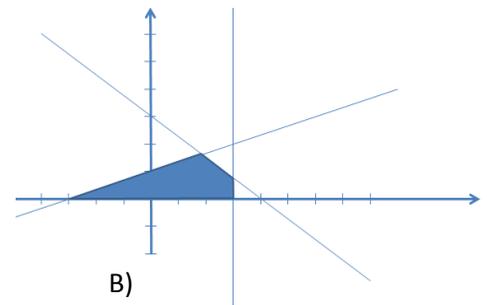
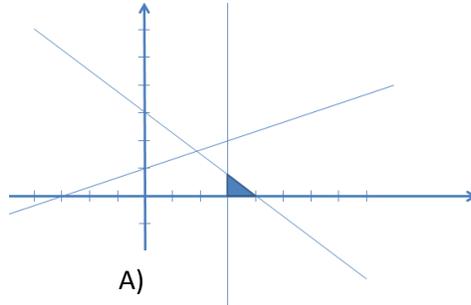
24) Shaded areas for an inequality:  
Which graph below correctly represents the following equations?

$$Y \geq 0$$

$$3x + 4y \leq 12$$

$$3Y - x \leq 3$$

$$X < 3$$



25) NU is offering a summer science camp. John, the organizer, has to pay \$500 to rent the lab where they will hold the camp. He needs to buy \$750 worth of supplies. The Union gave him a \$200 donation to help with the camp. If the campers pay \$150 each to attend, how many campers will John need to get in order to break even?

- A) 2 campers
- B) 5 campers
- C) 7 campers
- D) 9 campers

26) Which equation represents the profit made in the previous problem (P=Profit; C=# of campers)?

- A)  $P = (750 + 550 + 200) * (150C)$
- B)  $P = 150C - ((750 + 550) - 200)$
- C)  $P = ((750 + 550) - 200)$
- D)  $P = C(750 + 550) - 200$

27) You and a friend found a bag of coins. It contained the same number of nickels, dimes and quarters. Your friend offered you a deal: If you could figure out the number of each coin in the bag you could keep it all. If not, your friend would keep it all. The total amount of money was \$17.20. How many of each coin are in the bag?

- A) 17
- B) 172
- C) 40
- D) 43

**Cooking up trouble: Use the following information for the next two questions.**

A cookie recipe calls for the following:

- 3 eggs
- 1  $\frac{1}{2}$  cups of flour
- 2 tsp baking powder
- $\frac{2}{3}$  cup milk

But you look around your kitchen and find that you have the following:

- 1 egg
- 3 cups of flour
- 1 tsp baking powder
- 1 pint of milk

28) Which item is the limiting ingredient?

- A) Egg
- B) Flour
- C) Baking Powder
- D) Milk

29) To maintain the proportions called for in the recipe and just make a smaller batch, which combination would you use?

- A) 2 eggs, 1 cup flour, 1 tsp baking powder,  $\frac{1}{3}$  cup milk
- B) 1 egg, 1 cup flour, 1 tsp baking powder,  $\frac{1}{4}$  cup milk
- C) 2 eggs,  $\frac{1}{2}$  cup flour,  $\frac{2}{3}$  tsp baking powder,  $\frac{1}{3}$  cup milk
- D) 1 egg,  $\frac{1}{2}$  cup flour,  $\frac{2}{3}$  tsp baking powder,  $\frac{2}{9}$  cups of milk

30) You invest \$500 into an investment that pays 6% interest compounded annually. What is the balance at the end of year 5?

- A) \$548.50
- B) \$650
- C) \$669.12
- D) \$530

31) What is the measure of an exterior angle of a regular octagon?

- A) 45 degrees
- B) 60 degrees
- C) 90 degrees
- D) 360 degrees

32) What is the sum of the interior angles of a regular pentagon?

- A) 72 degrees
- B) 108 degrees
- C) 540 degrees
- D) 720 degrees

33) The height of a triangle is 4 inches greater than twice its base. The area of the triangle is 168 square inches. What is the base of the triangle?

- A) 120 inches
- B) 24 inches
- C) 12 inches
- D) 122 inches

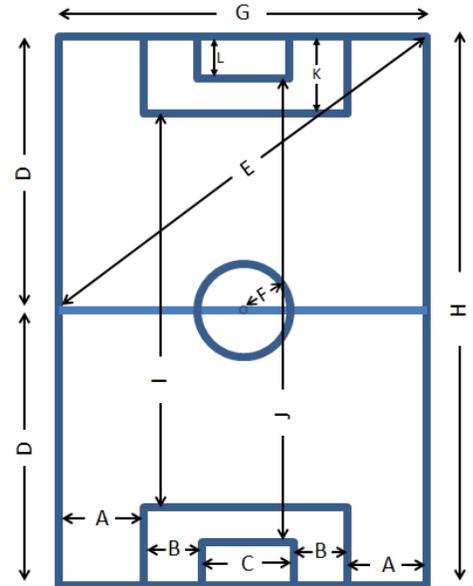
34) **Soccer field layout:**

Annie was hired to lay out and paint lines for a soccer field. Unfortunately, the diagram she was given for the field got damaged and some of the information was missing.

Given the partial field dimensions in the diagram below, and given that each can of paint covers 200 feet, how many cans of paint will Annie need to buy in order to paint all of the (thick) lines shown the field?

**Dimensions:**

- A: 40'
- B: Missing
- C: 20'
- D: Missing
- E: 200'
- F: 20'
- G: 160'
- H: Missing
- I: 180'
- J: 220'
- K: Missing
- L: Missing



- A) 5
- B) 7
- C) 8
- D) 12

Questions 34-38 are worth 4 points each

35) **Victor the Volume Verifier:**

Victor was called to a house to help determine how much a log would be worth. The lumber mill said that they would pay based on the volume of the wood. Their rate was \$.50 per cubic foot. The homeowner wasn't sure how to determine the volume, but Victor said it would be easy. He measured the radius of the log and it was a constant 5 feet all the way down the entire length. The log was 28 feet long. It only took Victor a few seconds to figure out the volume of the log. It was:

- A) 140cf
- B) 880cf
- C) 1,100cf
- D) 2,200cf

36) **Laila's Log Loaders:**

Laila's logging business has a fleet of five trucks. The CHP set a limit of 25 tons on the weight that each truck can carry. The trees that Laila is hauling are all the same dimension (4' diameter and 24 feet long). The wood has an average density of 20 pounds per cubic foot. What is the maximum number of whole logs that each truck can haul without exceeding the limit?

- A) 1 log
- B) 4 logs
- C) 8 logs
- D) 10.66 logs

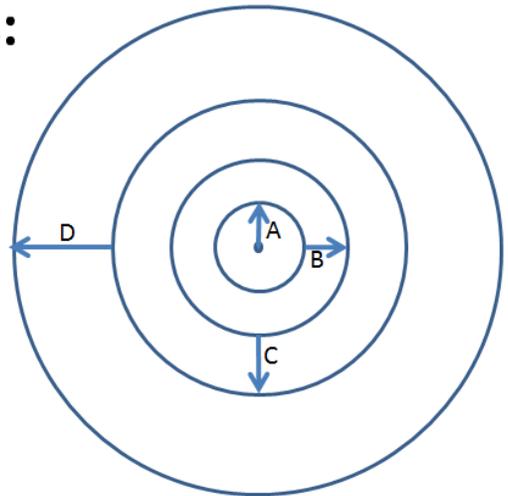
37) **Going in circles:**

The diagram is of a farmer's field. Each circle represents a different type of crop. He needs to know how large of an area that the outer two circles represent. Which of the following is the approximate area of the outer two circles?

- A) 78.5 square miles
- B) 113 square miles
- C) 537 square miles
- D) 616 square miles

**Dimensions:**

- A: 2 miles**
- B: 3 miles**
- C: 4 miles**
- D: 5 miles**



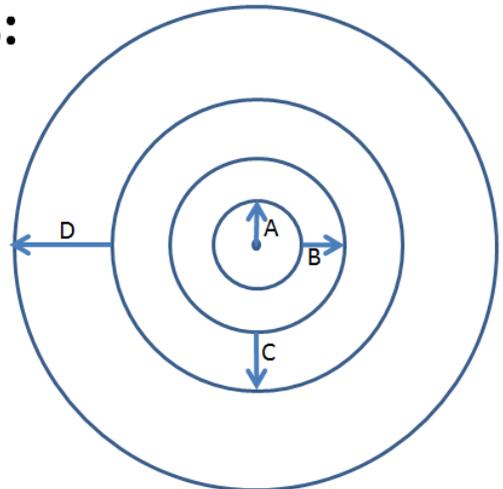
38) **Feeding the fields:**

A farmer is growing four different crops in concentric circles in the field shown. She needs to fertilize the crops in the outer two circle areas. If the fertilizer costs \$10 per gallon and it takes 5 gallons to cover one square mile, how much will it cost to fertilize the outer two circle areas?

- A) \$141
- B) \$707
- C) \$1,414
- D) \$7,070

**Dimensions:**

- A: 1 miles**
- B: 1 miles**
- C: 2 miles**
- D: 3 miles**



The Tie-Breaker is worth 5 points

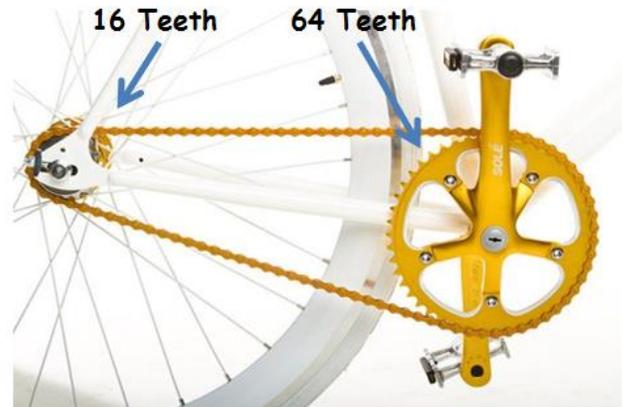
**\*\*\*\*\* Tie-Breaker \*\*\*\*\***

- 1) You were watching the Nevada City Classic bike race and started thinking about the bikes. If a bike had the following dimensions:

- Tire diameter = 30"
- Front sprocket: 64 teeth
- Back sprocket: 16 teeth

How many rotations of the pedal would it take for the bike to move forward 200'?

- A) 5.0
- B) 6.37
- C) 12.75
- D) 25.5



TechTest Jr. 2104 Answer Key: (100 points total)

The following are worth 1 point each (6 points total):

- 1: D
- 2: D
- 3: A
- 4: B
- 5: C
- 6: A

The following are worth 2 points each (24 points total):

- 7: A
- 8: C
- 9: B
- 10: D
- 11: B
- 12: C
- 13: B
- 14: B
- 15: A
- 16: C
- 17: D
- 18: B

The following are worth 3 points each (45 points total):

- 19: B
- 20: C
- 21: C
- 22: A
- 23: B
- 24: D
- 25: C
- 26: B
- 27: D
- 28: A
- 29: D
- 30: C
- 31: A
- 32: C
- 33: C

The following are worth 4 points each (20 points total):

- 34: C
- 35: D
- 36: C
- 37: C
- 38: D

Tie Breaker: B (5 points total)