Event 1: Computation Without Calculators (10 minutes)
(No calculators)

1. A semi-professional baseball league has teams with 21 players each. League rules state that every player must be paid at least $15,000, and that the total of the salaries of all the team's players cannot exceed $700,000. What is the maximum possible salary for a single player?
   20*15,000 + X = 700,000, so X = 400,000

   1) 400,000

2. Jenna makes lemonade using 200 grams of lemon juice, 200 grams of sugar, and 800 grams of water. There are 25 calories in 100 grams of lemon juice, and 193 calories in 50 grams of sugar. Water has no calories. How many calories are in 200 grams of Jenna's lemonade?
   1200 grams of lemonade have 2*25+4*193 calories, or 822 calories.
   200 grams would have 822/6 = 411/3 = 137 calories.

   2) 137

3. Tracy's aquarium contains one fish of each of the following colors: blue, green, orange, red, black, white, and purple. Sonia's aquarium contains exactly the same fish distribution as Tracy's aquarium. Sonia steals one random fish from Tracy's aquarium and adds it to her own. Tracy then steals one random fish from Sonia's aquarium and adds it to her own. What is the probability that the fish colors in Tracy's aquarium match those in Sonia's aquarium after the two exchanges?
   Tracy must take back a fish of the color Sonia stole.
   There are 2 of that color and (7+1) total fish, so 2/8 or 25%

   3) 25

4. Kelsey, Jordan, and Taylor run at constant speeds during a race that is 20 miles long. When Kelsey finishes, she is 4 miles ahead of Jordan and 8 miles ahead of Taylor. When Jordan crosses the finish line, how many miles does Taylor still have to run?
   Taylor is traveling 12/16 or ¾ the speed of Jordan, so when Jordan has gone 20 miles, Taylor will have gone 15 miles.

   4) 5

SOLUTIONS

Event 2: Problem Solving With Calculators (10 minutes)
(Calculator okay)

1. The math class took a test on Tuesday, and the average score was 32 points. Juan and Enrique were absent on Tuesday, so they took the test on Wednesday and scored 55 points and 60 points respectively. Including Juan's and Enrique's scores, the average score for the test rose to 35 points. What was the total number of students who took the test?

1) 17

(55+60+32*(n-2))/n=35

115+32(n-2)=35n; 51=3n, so n=17 or (15*32+55+60)/17=35

2. A piece of cheese is located at (12,10) in a coordinate plane. A mouse starts at (4,-2) and runs along the line $y = mx + b$. The mouse stops when it gets as close to the cheese as possible, at the point (c,d). If the slope, m, is -5, what is the sum $c+d$?

2) 10

We know -2=-5*4+b, so b=18 and y=-5x+18. The closest point is the intersection of y=-5x+18 and the perpendicular through (12,10).

10=1/5*12+B, so Y=1/5X+7.6. The lines intersect at (2,8), so c+d=10

3. Tour guides Darion, Kora, and Eli are leading a total of five tourists. The guides decide to split up the group such that each guide has at least one tourist. How many different groupings are possible?

3) 240

There are 3^5 possible groupings, but one has all 5 tourists with Darion, and another has all 5 with Kora, and another has all 5 with Eli.

3^5 - 3 = 243 - 3 = 240.

Event 3: Geometry & Measurement Problems (15 minutes)
(Calculator okay)

1. Four points, A, B, C, and D, lie sequentially on a line. The length of $\overline{AB}$ is 4 times the length of $\overline{BD}$, and the length of $\overline{AC}$ is 9 times the length of $\overline{CD}$. Fill in the blank:

   The length of $\overline{AD}$ is _____ times the length of $\overline{BC}$.

   $\overline{AD} = 5\overline{BD}$ and $\overline{AD} = 10\overline{CD}$

   $\overline{BC} = \overline{BD} - \overline{CD} = \frac{1}{5}\overline{AD} - \frac{1}{10}\overline{AD} = \frac{1}{10}\overline{AD}$

   1) 10

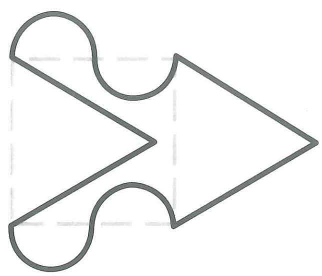
2. A sheet of paper begins as a square (dashed lines) with an area of A and a perimeter of P. An equilateral triangle is cut from the left of the square and attached to the right. A pair of semicircles are cut from the inside of the square and attached to the outside. The final shape still has area A, but it has a longer perimeter. Fill in the blank, rounding your answer to the nearest whole percent. The final shape has a perimeter that is ___% longer than P.

   2) 79

   P = 4L and L = P/4,

   $P_{new} = 4L + \pi L = P + \pi P/4$. Increase = $\pi P/4$

   $\pi P/4 \div P = \pi/4 = 0.7854$ or 79%



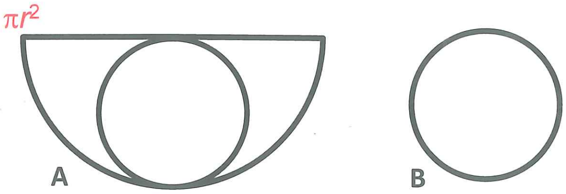
3. Shape A is created by removing circle B from a semicircle. The circular hole is tangent to the center of the semicircle as shown. Fill in the blank, rounding your answer to the nearest whole percent. The area of circle B is ____% of the area of shape A.

   3) 50

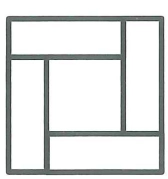
   Circle has radius r and area πr^2

   semicircle has radius $2r$

   and area $\frac{1}{2}\pi(2r)^2 = \frac{1}{2}\pi r^2$



4. Four identical rectangles are placed as shown to create two squares. The area of the outer square is 4 times that of the inner square. The long side of each rectangle is ___ times the length of the rectangle's short side.



   4) 3

   Rectangle has sides L and S.

   Small square is $(L-S)^2$

   Large square is $(L+S)^2$

   $(L+S)^2 = 4(L-S)^2$, so $(L+S)=2(L-S)$, and L=3S

SOLUTIONS

Event 4: Mental Math Problems (Timed PPT with 10 questions. About 25 seconds per question)

(No calculators)

1. $\frac{5}{6}-\frac{1}{?}=\frac{1}{4}+\frac{1}{3}$

1) 4

2. $7\cdot\left(\frac{5}{4}-\frac{4}{5}\right)\cdot\left(\frac{7}{3}-\frac{3}{7}\right)$

2) 6

3. $\frac{2^3+3^1+2^1+3^2+2^3}{2}$

3) 15

4. $\sqrt{\frac{6}{4}}\div\sqrt{\frac{8}{6}}\div\sqrt{\frac{2}{9}}$

4) 2.25 or 9/4

5. $2(13)-3(3)+5(7)-2(4)+7(2)$

5) 58

6. Area of a square with a diagonal of length 12

6) 72

7. $\frac{(3-11)-(4-37)}{(9-4)}$

7) 5

8. 40% less than a fourth of 40% more than 40

8) 8.4

9. $\sqrt{11+\sqrt{\sqrt{11+14}+\sqrt{11+110}+\sqrt{11+70}}}$

9) 4

10. $3+3(2+2(1+1(1)^{-3})^{-2})^{-1}$

10) 4.2 or 4 1/5 or 21/5

SOLUTIONS

Event 5: Team Problem Solving (20 minutes. Calculators okay.)

1. A parabola with the equation $y = x^2 + bx + c$ passes through the points (1,2) and (3,2). What is the area of the triangle formed by the intersection of the lines $y = bx + c$, $y = cx + c$, and $x = b$?

2=1+b+c and 2=9+3b+c, so b=-4 and c=5.

The triangle has vertices at (0,5), (-4,21), and (-4,-15).

Letting the vertical line at x=-b be the base, the area is ½ (36)(4) = 72

1) 72

2. Bricklayer Portia would take 10 hours to build a chimney with B bricks when working alone. Bricklayer Blanca would take 9 hours to build the same chimney on her own. Working together, they built the chimney in 5 hours, but since they argued continually, their combined output was decreased by 10 bricks per hour. How many bricks were in the chimney?

B/10 + B/9 - 10 = B/5, so B = 900

2) 900

3. One quarter of a circle is removed to create shape A at the left. Shape A has an area of 3π and a perimeter of *P*. Rounded to the nearest tenth, what is the area of an equilateral triangle, B, constructed with the same perimeter, *P*? Let the triangle have sides of length L_{tri}

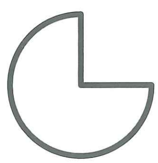
$A = \frac{3}{4}\pi r^2 = 3\pi$, so $r = 2$

$P = \frac{3}{4}(2\pi \cdot 2) + 2 + 2 = 3\pi + 4$

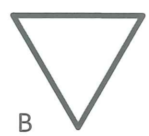
$L_{tri} = P/3 = \pi + \frac{4}{3}$

$A = \frac{\sqrt{3}}{4} L_{tri}^2 = 8.671 \approx 8.7$

3) 8.7



A



B

4. Arturo and Diego bike toward one another with Diego traveling 2/3 as fast as Arturo, and the distance between them decreasing at a rate of 1 kilometer per minute. At 1:30pm they are 20 kilometers apart, and 4 minutes later Arturo stops biking because of a flat tire. At what time does Diego reach Arturo?

4) 2:14pm

$2/3V_a = V_d$ and $V_a + V_d = 1$, so $V_d = 0.4$ km/min

At 1:34pm they are 16 km apart, so Diego has 16 km to go at 0.4 km/min, which will take 40min

1:34+0:40 = 2:14pm