FHSU Math Relays Sample Test
Event 1
Using Number Sense

1. Which of the following has the smallest value?

   A) 4^0 B) 2^{-1} C) 3^{-1} D) 4^{-1} E) 4^1

2. If $x \geq 20$, what is the median of this set of numbers? 10, 18, 7, 2, 9, 11, x

   A) 2   B) 11   C) 9   D) 10   E) Cannot be determined

3. The value of $\sqrt{5^2 - 3^2}$ is

   A) 2   B) 3   C) 4   D) 5   E) 16

4. Five of the numbers in a list of seven integers are 3, 4, 7, 9, 11. What is the smallest possible value of the median of the seven integers?

   A) 3   B) 4   C) 7   D) 9   E) 11

5. How many prime numbers less than 15 are there?

   A) 3   B) 4   C) 5   D) 6   E) 7

6. What are the first two digits (in order) in the decimal expansion of $\frac{1}{11}$?

   A) 1 and 0   B) 1 and 1   C) 1 and 9   D) 0 and 1   E) 0 and 9

7. If two squares have areas of 49 and 100 square units, then the ratio of the smaller square's side length to the larger square's side length must be

   A) $\frac{49}{100}$ B) $\frac{7}{10}$ C) $\frac{49^2}{100^2}$ D) $\frac{10}{7}$ E) $\frac{1}{2}$

8. What are the prime factors of 231?

   A) 1, 3, 7   B) 11, 21   C) 3, 7, 11   D) 7, 33   E) 231 is prime

9. Find the ratio of 3 cups to 4 quarts.

   A) $\frac{3}{16}$ B) $\frac{3}{4}$ C) $\frac{3}{8}$ D) $\frac{4}{3}$ E) $\frac{16}{3}$

10. Simplify: $3[5 - 2(x + 1)]$

   A) $3 - 2x$ B) $2 - 6x$ C) $9 - 6x$ D) $9x + 9$ E) none of these

1. Convert $\frac{7\pi}{12}$ radians to degree measure.

   A) $210°$ B) $105°$ C) $110°$ D) $309°$ E) $53°$

2. Find the exact value of $\tan\left(\frac{5\pi}{4}\right) + \cos\left(\frac{3\pi}{4}\right)$.

   A) $\frac{\sqrt{2}-2}{3}2$ B) $\frac{\sqrt{2}+2}{3}$ C) $\frac{1-\sqrt{2}}{2}$ D) $\frac{2-\sqrt{2}}{2}$ E) 0

3. An object is traveling around a circle with a radius of 10 yards. If in 45 seconds a central angle of $\frac{1}{3}$ radian is swept out, what is the linear speed of the object?

   A) $\frac{2}{27}$ radians/second   B) $13\frac{1}{2}$ radians/second   C) $\frac{2}{27}$ yards/second   D) $13\frac{1}{2}$ yards/second   E) $\frac{2}{27}$ seconds/yard

4. Find $\tan\theta$ if $\sin\theta = \frac{1}{2}$.

   A) $\tan\theta = 2$ B) $\tan\theta = \frac{1}{\sqrt{3}}$ C) $\tan\theta = \sqrt{3}$ D) $\tan\theta = \frac{\sqrt{3}}{2}$ E) $\tan\theta = \frac{2}{\sqrt{3}}$

5. For the equation $y = -\frac{2}{3}\cos(2x+2\pi)$, identify the amplitude and period.

   A) amplitude $= -2$, period $= \pi$ B) amplitude $= \frac{2}{3}$, period $= \pi$ C) amplitude $= 2$, period $= 2\pi$ D) amplitude $= \frac{-2}{3}$, period $= \frac{\pi}{2}$ E) amplitude $= 4$, period $= 2\pi$

6. Find the exact value of $\sin(2\beta)$ if $\sin(\beta) = \frac{5}{13}$ and β lies in quadrant II.

   A) $-\frac{120}{169}$ B) $\frac{119}{169}$ C) $\frac{10}{13}$ D) $\frac{120}{169}$ E) $-\frac{119}{169}$

7. Find the exact value of $\cos^{-1}\left(\frac{1}{2}\right)$ or $\arccos\left(\frac{1}{2}\right)$.

   A) $\frac{5\pi}{6}$ B) $\frac{\pi}{3}$ C) $\frac{\pi}{6}$ D) $\frac{\pi}{4}$ E) $-\frac{\pi}{6}$

8. Solve the equation $\tan^2 x - 2 = 1$, where $0° \le x < 360°$.

   A) $60°, 120°, 240°, 300°$ B) $30°$ C) $60°, -60°$

   D) $210°, 330°$ E) $30°, 150°, 210°, 330°$

9. Solve a standard labeled triangle for α, the angle opposite side a, given that $a = 20$, $b = 17$, and $c = 13$. Round your degree-valued answer to two decimal places.

   A) $\alpha = 32.58°$ B) $\alpha = 7.54°$ C) $\alpha = 82.46°$ D) $\alpha = 57.42°$ E) $\alpha = 40.12°$

10. Find the rectangular coordinates of the polar point $(3, 30°)$

   A) $\left(-\dfrac{3\sqrt{3}}{2}, -\dfrac{3}{2}\right)$ B) $\left(\dfrac{3\sqrt{3}}{2}, \dfrac{3}{2}\right)$ C) $\left(\dfrac{3\sqrt{2}}{2}, \dfrac{3}{2}\right)$ D) $\left(-\dfrac{3\sqrt{2}}{2}, \dfrac{3}{2}\right)$ E) none of these

1.   Reduce to lowest terms: $\dfrac{(x+1)(3x+6)(x-3)}{(x-1)(x+2)(x-3)}$

A) $\dfrac{x-1}{x+1}$

B) $\dfrac{-(3x+6)}{x+2}$

C) $\dfrac{(x+1)(3x+6)}{(x-1)(x+2)}$

D) $\dfrac{3(x+1)}{x-1}$

E) -2

2. Simplify: $\sqrt{12}+2\sqrt{27}$

A) $3\sqrt{3}$

B) $4\sqrt{3}$

C) $3\sqrt{39}$

D) $8\sqrt{3}$

E) $7\sqrt{3}$

3. Simplify: $\dfrac{2x^{-2}}{x^{-3}y^{-4}}$

A) $\dfrac{xy^2}{2}$

B) $2xy^4$

C) $2x^5y^4$

D) $\dfrac{x^5y^4}{2}$

E) $\dfrac{2x}{y^6}$

4. Factor completely: $2x^3-4x^2-6x$

A) $x=0, x=3, x=-1$

B) $2x(x-3)(x+1)$

C) $2(x^3-2x^2-3x)$

D) $2x(x^2-2x-3)$

E) $2x(x+3)(x-1)$

5. Solve for x: $x^2-2x=2$

A) $x=2\pm\sqrt{12}$

B) $x=2\pm\sqrt{-4}$

C) $x=3,\ x=1$

D) $x=1\pm\sqrt{3}$

E) $x=-1\pm\sqrt{3}$

6. Write the expression as a single logarithm: $3\log x - 2\log y$

A) $\log\left(\dfrac{3x}{2y}\right)$ B) $\log(3x - 2y)$ C) $\log\left(\dfrac{x^3}{y^2}\right)$

D) $\log(x^3 - y^2)$ E) $6\log\left(\dfrac{x}{y}\right)$

7. Solve for a: $2 + \dfrac{5}{a-2} = \dfrac{a+3}{a-2}$

A) $a = 2$ B) $a = 4$ C) $a = -2$

D) $a = -4$ E) There is no solution.

8. Solve for x: $\sqrt{3x-5} = x - 1$

A) $x = 2, x = 3$ B) $x = 2$ C) $x = -2, x = 3$

D) $x = 2, x = -3$ E) $x = 3$

9. Multiply and collect similar terms: $(3 - 2i)(1 + i)$

A) $5 + i$ B) $7 - 3i$ C) $12 - 3i$

D) $3 + 5i$ E) $3 - i - 2i^2$

10. Solve for x: $|2x - 1| \le 5$

A) $x \le 3$ B) $x \le 2$ C) $2 \le x \le 3$

D) $-2 \le x \le 3$ E) $-3 \le x \le 3$

FHSU Math Relays Sample Test
Event 4
Informal Geometry, Measurement

1. If the legs of a right triangle are 7 and 24 inches long, then the perimeter of the triangle is:

    A) 31 in   B) 25 in   C) 17 in   D) 56 in   E) Not enough info

2. What is the sum of the exterior measures of a pentagon?

    A) 180   B) 540   C) 360   D) 108   E) 90

3. What is the volume of a sphere having diameter 10 cm?

    A) $\dfrac{500}{3}\pi$ cm^3 B) 100π cm^2 C) 25π cm^3 D) $\dfrac{1000}{3}\pi$ cm^2 E) 125π cm^3

4. What is the surface area of a right cylinder with radius of 2 in and height of 10 in?

    A) 40π in^2 B) 80π in^2 C) 400π in^2 D) 320π in^2 E) 48π in^2

5. What is the perimeter of a square whose diagonal is $7\sqrt{2}$ meters?

    A) 49 m   B) 28 m   C) 98 m   D) 14 m   E) Not enough info

6. A rectangular piece of cardboard 8 in. by 11 in. is made into an open top box by cutting a square on a side from each corner and folding up the sides. What is the maximum volume of the box?

    A) 60 in^3 B) 88 in^3 C) 56 in^3 D) 100 in^3 E) 968 in^3

7. If $m\angle 5 = 35°$ and $m\angle 4 = 115°$ then the $m\angle 3 =$

    A) 145°   B) 60°   C) 65°

    D) 25°   E) Not enough info
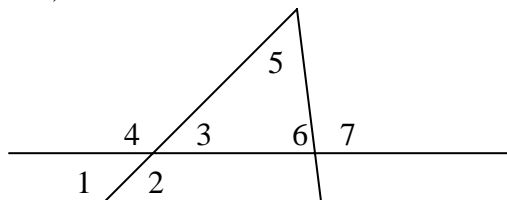
8. How does the volume of a right circular cylinder change if the height is tripled?

    A) 4 times larger   B) 2 times larger   C) three times larger   D) nine times larger

9. If the diagonals of a quadrilateral bisect each other at right angles, the figure is a

    A) trapezoid   B) isosceles trapezoid   C) parallelogram   D) rectangle   E) rhombus

10. Which of the following is not a sufficient condition to determine if two right triangles are congruent?

    A) Hypotenuse and leg of one triangle congruent to hypotenuse and leg of the other triangle.
    B) Hypotenuse and an adjacent angle of one triangle congruent to hypotenuse and adjacent angle of the other triangle.
    C) Leg and one angle of one triangle congruent to leg and one angle of the other triangle.
    D) Legs of one triangle congruent to legs of the other triangle.

1. Tom works for a company. He earns $12/hr for regular hours (40 hours a week). He earns $6 more per hour for extra hours. If he earned a total of $606 last week, how many hours did he work last week?
   A) 7 hours   B) 21 hours   C) 47 hours   D) 33 hours   E) 60 hours

2. A rectangular swimming pool is four times as long as it is wide. If the area of the pool is 2500 ft^2, what is the length?
   A) 25   B) 100   C) 125   D) 250   E) 200

3. A machinist runs a machine to make bolts. She earns $.05 a bolt. She earns an average of $360.00 in five days. On average how many bolts did she make per day?
   A) 720   B) 1440   C) 288   D) 1800   E) 1000

4. An instructor counts the final exam twice as much as any one of the four one-hour exams. What is the average score of a student who receives scores of 68, 85, 60,and 89 on the four hour exams and 95 on the final exam?
   A) 80   B) 75   C) 89   D) 82   E) 90

5. For young children, a child's height H in centimeters is related to his/her age A in months with the following formula: H=71.95 + 0.3833A. Sarah is 4 years old. What is her predicted height?
   A) 73.4832   B) 81.95   C) 90.35 cm   D) 27.57   E) 77.28

6. Two women are painting a barn. Barbara can paint it alone in 12 days. Sara can paint it alone in 10 days. Working together, how long will it take them?
   A) 22 days   B) 11 days   C) 6 days   D) 8 days   E) 5.45 days

7. A positive integer is 3 more than 4 times its reciprocal. What is the integer?
   A) 7   B) 1/3   C) 3   D) 4   E) 1/7

8. A group of people is taking a charter flight to Mexico. The total group cost of the trip is $3000. If they can find 10 more people to take the trip, the cost for each person will be reduced by $50. How many people were there in the original group?
   A) 20   B) 30   C) 50   D) 100   E) 45

9. How much water must be evaporated from 32 ounces of a 15% salt solution to make a 20% salt solution?
   A) 12 ounces   B) 15 ounces   C) 10 ounces   D) no solution   E) 8 ounces

10. If a rock falls from a height of 350 meters on earth, the height H (in meters) after t seconds is approximately $H(t)= 350 - 4.9\ t^2$. When does the rock strike the ground?
    A) 10 seconds   B) 350 seconds   C) 4.9 seconds   D) 8.45seconds   E) 5.84 seconds

1. Which one of the following is not a solution of the equation $(x+2)^4 - 20(x+2)^2 + 64 = 0$?
    A) –6   B) –4   C) –2   D) 0   E) 2

2. $\dfrac{2.176 \times 10^9}{(8.413 \times 10^6)(2.5 \times 10^9)} \div \dfrac{(1.7 \times 10^{-3})(4.5 \times 10^5)}{(3.17 \times 10^{11})}$
    A) 1.03×10^{-7} B) 6325.39   C) 42.87   D) 4.58×10^{25} E) -1.75×10^{-9}

3. Find $2003\left(1 + \dfrac{r}{n}\right)^n$ if $n = 11 \times 12 \times 365$ and $r = .055$
    A) 2003.00   B) 2116.25   C) 7700.27   D) 4346.44   E) 1001.23

4. Solve for a: $\pi\left(\dfrac{a}{2}\right)^4 = 56.32$
    A) 1.28   B) 6.89   C) 5.32   D) 1.11   E) 4.12

5. $\left(\dfrac{1}{(1.79)^2 + (4.78)^{-2}}\right)^{-2} =$
    A) .0949   B) 678.603   C) 10.549   D) 319.694   E) 7.896

6. $2 + \sqrt{\dfrac{(1.11)^3 - 1}{(1.11)^3 + 1}} + (2.75)\sqrt{\dfrac{(1.11)^3 - 1}{(1.11)^3 + 1}} =$
    A) 11.52   B) 2.36   C) 7.10   D) 3.48   E) 5.14

7. Simplify $\dfrac{3!7!}{10!}$
    A) 1   B) 2345   C) 120   D) 0.0083   E) 3

8. Find $\ln(3x^2 - 4x + 2)$ if $x = \dfrac{1}{3}$
    A) .9617   B) 1.2119   C) 1.8027   D) 0   E) no real solution

9. If $x = .66$ and $y = \sqrt{1 - x^2}$, what is $x^4 - y^4$?
    A) 0   B) -.1288   C) .1288   D) -.6786   E) .6786

10. Find A: $\dfrac{\cos 75°}{3.5} = \dfrac{A}{\cos 15°}$
    A) 17.35   B) .145   C) .0714   D) 14   E) -.004