1. Find the domain of $f^{-1}(x)$ if $f(x)=\dfrac{2x+1}{x-1}$.

   A. $\{x \mid x \neq 1\}$

   B. $\{x \mid -\infty < x < \infty\}$

   C. $\{x \mid x > 1\}$

   D. $\{x \mid x \neq 2\}$

   E. $\{x \mid x \neq 0\}$

2. In the trapezoid $ABEF$, $AC = CE$ and $BD = DF$. Find CD

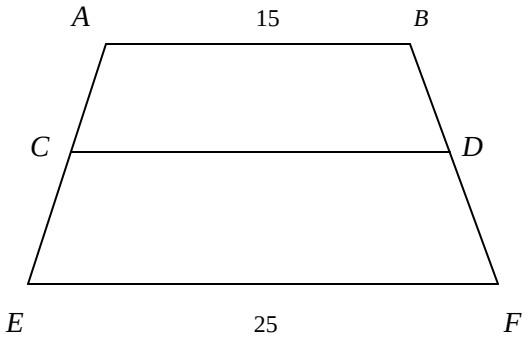
   A. 12

   B. 20

   C. 18

   D. 21

   E. 23



3. Find $\left(\dfrac{\sqrt{3}}{2}+\dfrac{i}{2}\right)^{12}$

   A. 0

   B. $\sqrt{2}/2$

   C. $-\sqrt{2}/2$

   D. -1

   E. 1

4. Timothy is now 100% older than his younger sister. In eight years he will only be 20% older. What is the sum of their ages now?

   A. 10

   B. 12

   C. 6

   D. 8

   E. 20

5. Given that the triangle has perimeter of 32 meters, find the value of x

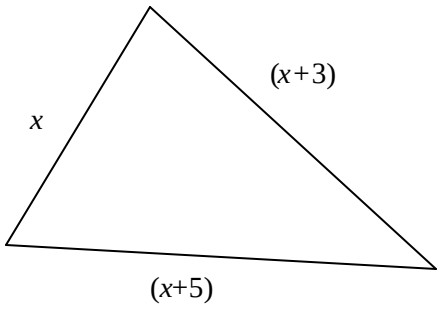
   A. 8 meters

   B. 10 meters

   C. 12 meters

   D. 6 meters

   E. 7 meters



6. If $\sin q + \cos q = \frac{1}{5}$, then the value of $\sin 2q$ is

   A. $24/25$

   B. $2\sqrt{6}/5$

   C. $-24/25$

   D. $-2\sqrt{6}/5$

   E. $-19/25$

7. (Tie Break No.1) Find $x^2 + y^2$ if x and y are positive integers such that $xy + x + y = 71$ and $x^2 y + xy^2 = 880$.

A. 105

B. 146

C. 152

D. 160

E. 175

8. Write the repeating decimal $0.012121212\cdots$ as a rational number.

A. $\frac{3}{25}$

B. $\frac{3}{250}$

C. $\frac{4}{33}$

D. $\frac{4}{333}$

E. $\frac{2}{165}$

9. $2x + 4y = 16$ is the equation of a line tangent to a circle with center at $(-6, 2)$. What is the radius of the circle?

A. $4\sqrt{2}$

B. $2\sqrt{5}$

C. $3\sqrt{7}$

D. 4

E. 5

10. A boy agreed to work for one year for \$240 and a horse. At the end of 7 months, he quit and received \$100 and the horse. What was the value of the horse?

A. \$100

B. \$96

C. \$90

D. \$85

E. \$82

11. $\sqrt[3]{\sqrt{30}+\sqrt{3}}\cdot\sqrt[3]{\sqrt{30}-\sqrt{3}}=?$

A. $\sqrt[3]{891}$

B. $\sqrt[3]{33}$

C. 8

D. 3

E. $\sqrt[3]{99}$

12. The initial swing of the tip of a pendulum is 25 cm. If each swing of the tip is 80% of the preceding swing, how far does the tip travel before eventually coming to rest?

A. 250 cm

B. 200 cm

C. 150 cm

D. 125 cm

E. 100 cm

13. If the ratio of $\sin x$ to $\cos x$ is 1 to 2, then the ratio of $\tan x$ to $\cot x$ is

A. 1:4

B. 1:2

C. 1:1

D. 2:1

E. 4:1

14. If a line through the points $(2,-6)$ and $(k, 9)$ is perpendicular to $4x + 6y = 7$, then $k = ?$

A. 24.5

B. -20.5

C. 12

D. 8

E. -8

15. In the figure given below, two equal circles have their centers on the diagonal *AC* of the square *ABCD*. The circles just touch each other and the sides of the square. If the side of the square is of length *s*, find the total area of the two circles in terms of *s*.

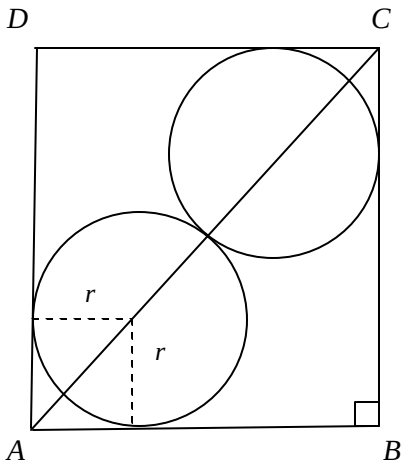
A. $\sqrt{2}ps^2$

B. $2\sqrt{2}ps^2$

C. $3\sqrt{2}ps^2$

D. $(3-2\sqrt{2})ps^2$

E. $(3-2/\sqrt{2})ps^2$



16. (Tie Break No. 2) If $PA = 8$, $PB = 5$, and $PC = 10$, then $PD = ?$

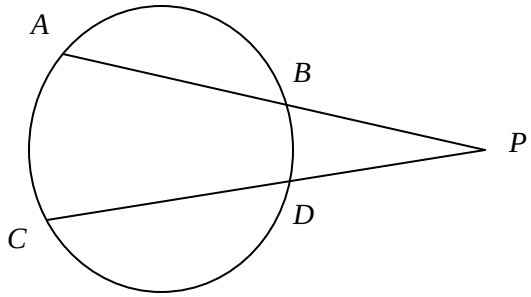
A. 6.25

B. 16

C. 7.5

D. 4

E. 6



17. For all values of q ?for which $\dfrac{\tan q - \cos^3 q \sin q - \cos q \sin^3 q}{\sin q \tan q}$ is defined, it is equal to what trigonometric function?

A. $\sin q$

B. $\cos q$

C. $\tan q$

D. $\cot q$

E. $\sec q$

18. Three circles with centers *A*, *B*, and *C* are tangent to each other and their centers are on the line *DF*. Each circle has radius 5. Lines *DE* and *FG* are tangent to the circle with center *C* and intersect at *G*. Find the length of *FG*.

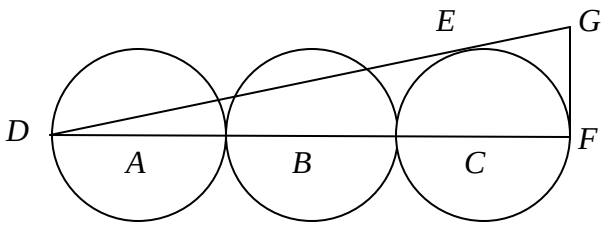
A. $\dfrac{25}{26}\sqrt{26}$

B. $\dfrac{25}{2}\sqrt{6}$

C. $\dfrac{15}{13}\sqrt{26}$

D. Not enough information

E. $\dfrac{5}{2}\sqrt{6}$



19. Let $f(x)=\dfrac{ax+b}{cx+d}$. If $c\neq 0$, under what condition is $f(x)=f^{-1}(x)$?

A. $a=0$

B. $b=-d$

C. $a=d$

D. $a=c$

E. $a=-d$

20. Which of the following is equal to $5\log_{15}(15x)-\log_{15}x^5$?

A. 5

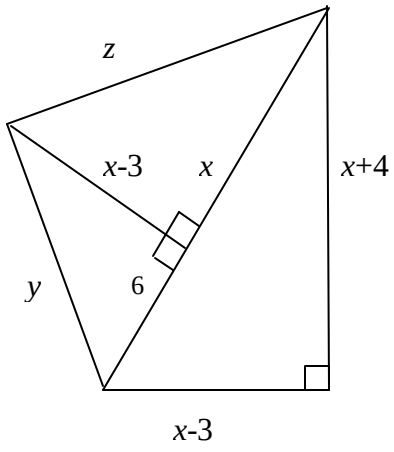
B $105x^2$.

C. 105

D. $5\log_{15}\dfrac{15}{x}$

E. $5\log_{15}4x$

21. Using the information given by the figure, find $x+y+z$.



A. 44

B. $40+\sqrt{65}$

C. $21+\sqrt{185}$

D. $44+\sqrt{185}$

E. 21

22. The solution set for the inequality $\frac{1}{x-2} < \frac{1}{x+3}$ is

A. $(-3, -2)$

B. $(-3, 2)$

C. $(2, 3)$

D. $(-2, 2)$

E. $(0, 2)$

23. A peanut jar in the shape of a right circular cylinder is 4 inches high and 3 inches in diameter and sells for \$1.20. If we assume that cost is directly proportional to volume, how much should a jar 6 inches high and 6 inches in diameter cost?

A. \$3.60

B. \$4.80

C. \$6.00

D. \$7.20

E. \$8.40

24. If $3x + 4 = 2(y + 2)$, the ratio $y : x$ is

A. $2:3$

B. $3:2$

C. $1:1$

D. $7:4$

E. $4:7$

25. If P_1 and P_2 are the points of intersection of two circles whose equations are $x^2 + y^2 = 4$ and $(x-2)^2 + (y-2)^2 = 4$, what is the slope of the line perpendicular to the line that passes through P_1 and P_2?

A. 0

B. 1

C. -1

D. 2

E. The slope is undefined

26. The growth rate of a certain organism varies jointly as the warmth of the sun and the square of the available food, and inversely as the number of enemies. If the growth rate remains constant when the warmth of the sun is cut in half and the number of enemies doubles, what can be said about the quantity of available food?

A. It is doubled

B. It is 4 times as great

C. It is cut in half.

D. It is divided by 4

E. It remains the same

27. In an arithmetic sequence the first term is 2 and the last term is 29. The sum of all the terms is 155. Find the common difference.

A. 3

B. 2

C. 4

D. 5

E. None of the above

28. (Tie Break No. 3) The remainder when $f(x) = 4x^4 + 10x^3 + kx^2 + bx - 2$ is divided by $x+1$ is -3, and the remainder is 25 when $f(x)$ is divided by $x-1$. Determine the remainder when $f(x)$ is divided by $x+2$.

A. 66

B. 9

C. 10

D. 4

E. 186

29. Find the value of *K* for which the following system has no solution: $\begin{cases} Kx + 3y = 7 \\ 2x - 5y = 3 \end{cases}$

A. 2

B. 5

C. 3

D. $-4/5$

E. $-6/5$

30. If $f(x) = \log\dfrac{1+x}{1-x}$ and $g(x) = \dfrac{3x + x^3}{1+3x^2}$, then $f[g(x)] = ?$

A. $-f(x)$

B. $\dfrac{1}{f(x)}$

C. $[f(x)]^3$

D. $3f(x)$

E. $[f(x)]^2$

31. Simplify $\dfrac{3+2i}{1-i}+\dfrac{6+2i}{1+i}$

A. $\dfrac{9}{2}+\dfrac{i}{2}$

B. $\dfrac{3}{2}+\dfrac{5i}{2}$

C. $6-4i$

D. 8

E. i

32. A circular sheet of paper of radius 6 inches is cut into 3 equal sectors, and each sector is formed into a cone with no overlap. What is the height in inches of each cone?

A. 4

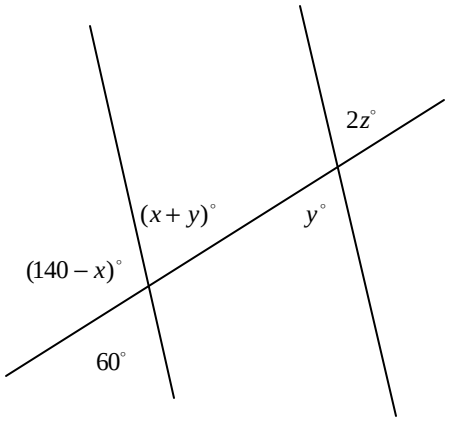
B. $5\sqrt{2}$

C. 3

D. 5

E. $4\sqrt{2}$

33. Find $x+y+z$ using the information given by the figure.



A. 105°

B. 90°

C. 60°

D. 100°

E. 80°

34. If the height of a right circular cylinder is halved while the diameter is tripled, the ratio of the new volume to the old volume is?

A. 3:2

B. 3:1

C. 9:2

D. 7:2

E. 5:2

35. (Tie Break No.4) Suppose that $\sec x + \tan x = \frac{22}{7}$ and that $\csc x + \cot x = \frac{m}{n}$ where $\frac{m}{n}$ is in lowest terms. Find $m+n$.

A. 35

B. 52

C. 15

D. 44

E. 20

36. The three-digit number 2*a*3 is added to the number 326 to give the three-digit number 5b9. If 5*b*9 is divisible by 9 then $a+b$ equals

A. 2

B. 4

C. 6

D. 8

E. 9

37. Determine the exact value of $\sec\left(\tan^{-1}\frac{4}{3}+\cot^{-1}\frac{5}{12}\right)$.

A. $-\frac{7}{4}$

B. $\frac{56}{15}$

C. $\frac{-33}{65}$

D. $\frac{33}{65}$

E. $-\frac{65}{33}$

38. One interior angle of a rhombus of side-length 4 has a measure of 75 degrees. Find the area of the rhombus.

A. $2(\sqrt{2}+\sqrt{6})$

B. $2(\sqrt{3}+\sqrt{6})$

C. $4(\sqrt{2}+\sqrt{6})$

D. $4(\sqrt{3}+\sqrt{6})$

E. $8(\sqrt{2}+\sqrt{6})$

39. If * represents an operation defined by $a*b=a^b+b$, find $(1*2)*3$.

A. 20

B. 25

C. 35

D. 30

E. 40

40. Let x and y be positive angles less than 360°. If $\csc(2x+30^\circ) = \cos(3y-15^\circ)$, which of the following values **can not be** the sum of x and y?

A. 185°

B. 65°

C. 35°

D. 215°

E. 605°

41. What is the equation in rectangular coordinates of the curve whose polar equation is $r = 2\sec q + \cos q$?

A. $x^2 - x - 2y + y^2 = 0$

B. $x^3 - 3x^2 + xy^2 - 2y^2 = 0$

C. $x^3 - x^2 + xy^2 - 2 = 0$

D. $x^2y - 2x^2 - xy - 2y^2 + y^3 = 0$

E. $x^2y - 2x^2 - 3y^2 + y^3 = 0$

42. (Tie Break No.5) The gold was missing. The thief was either the butler, the maid, or the cook. During the investigation, each made the following statement: Butler: "The maid stole the gold". Maid: "That is true." Cook: "I did not steal the gold." At least one of them lied and at least one of them told the truth. Who stole the gold?

A. The butler

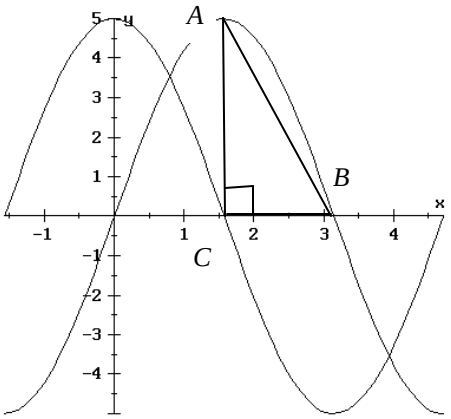
B. The maid

C. The cook

D. None of them

E. Not enough information

43. A triangle *ABC* is inscribed between the graphs of $f(x) = 5\sin x$ and $g(x) = 5\cos x$ Find the area of triangle *ABC*.



A. $\frac{5p}{8}$

B. $\frac{p}{4}$

C. $\frac{p}{8}$

D. $\frac{5p}{4}$

E. Not enough information is given.

44. The absolute maximum of $f(x) = \cos 2x - 2\cos x$ on $[0, 2p]$ occurs at $x = ?$

A. $\frac{p}{3}$

B. $\frac{p}{2}$

C. p

D. $\frac{5p}{3}$

E. $\frac{3p}{4}$

45. If the following steps are followed in order, what sequence of numbers will be printed?

1. Let $x = A = 2$
2. If $x \geq 5$, stop
   If $x < 5$, print the value of x
3. Replace x by $x + 1$
4. Replace A by $2A - 1$
5. If $A \leq x$, print the value of A
   If $A > x$, go back to step 2
6. Stop

A. 2,3,4

B. 2,3,4,5

C. 2,3,3,4

D. 2,3

E. 2,3,3,4,5