Question 1	Question 2
Let $S = \begin{bmatrix} \sin 60^\circ & \cos 60^\circ \\ \cos 60^\circ & \sin 60^\circ \end{bmatrix}$ and $T = \begin{bmatrix} \cos 30^\circ & \sin 30^\circ \\ \sin 30^\circ & \cos 30^\circ \end{bmatrix}$. Find the determinant of ST.	Find the value of $2 + \cfrac{1}{1 + \cfrac{1}{2 + \cfrac{1}{1 + \cfrac{1}{2 + \cfrac{1}{\ddots}}}}}$
Question 3	**Question 4**
Let $a = \log_4(e^{3\ln 4})$ $b = \lvert 3i^{741} - 4i^{954} \rvert$ $c =$ sum of x and y which are the solutions of $\begin{matrix} 9x+7y=2 \\ 4x+3y=-5 \end{matrix}$ Then evaluate $\dfrac{a^2 - ab}{\lvert a+b-c \rvert}$	Carmen has 2007 cans of paint. What is the maximum number of colors she has if she is guaranteed to have at least 345 cans of each color?

Question 5

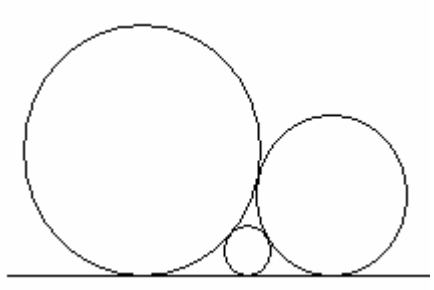
Evaluate: $\lim_{x\to 2}\dfrac{\sqrt{3x-5}-1}{x^3-8}$

Question 6

Evaluate: $\cos\left[\dfrac{\pi}{4}+\dfrac{\pi}{2}+\dfrac{3\pi}{4}+\pi+\ldots+22\pi\right]$

Question 7

In the picture below the largest circle has radius of 2 and the middle-sized circle has radius of 1. Find the radius of the smallest circle.

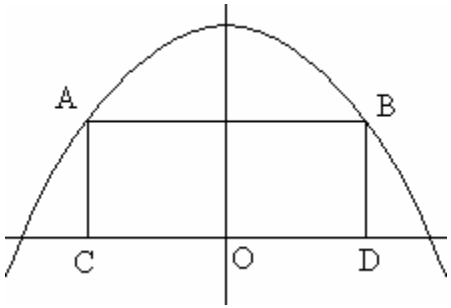


Question 8

For what values of x will the functions $f(x)=\dfrac{\sqrt[4]{x-2}}{x-5}$ and $g(x)=\ln\left(3-\sqrt{x-1}\right)$ both be defined?

Question 9

A rectangle *ABCD* has side *CD* on the *x*-axis, and touches the graph of $y = k\cos(x)$ at points *A* and *B* as shown. If the length of *CD* is $\frac{\pi}{3}$ and area of the rectangle is $\frac{5\pi}{3}$. Find the value of *k*.



Question 10

Fill in each square below with one of the following symbols $+,-,\div,\times$ in such a way that all the below conditions are satisfied.

a) Every row must contain all four symbols.
b) Every column of squares must contain all four symbols.
c) When all boxes are filled each resulting equation must be valid.

10	□	1	□	4	=	10	□	2	□	1
2	□	1	□	2	□	4	□	10	=	7
12	□	2	=	1	□	3	□	2	□	1
3	□	11	□	6	□	3	=	3	□	4
8	=	3	□	5	□	2	□	10	□	2

Question 11

Let A = the distance between $3x - 4y = 7$ and $3x - 4y = -3$
Let B = the slope of a line perpendicular to $5x - 2y = 6$

Find $\frac{A}{B}$

Question 12

Find the smallest positive integer in which, when divided by 9 the remainder is 6 and when divided by 17 the remainder is 13.

Question 13	Question 14
Notice $1=\frac{1}{2}+\frac{1}{3}+\frac{1}{6}$, can you find 5 different integers a,b,c,d,e so that $1=\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+\frac{1}{d}+\frac{1}{e}$. Give 10 different integers $a_1,a_2,\cdots,a_{10}$ so that $1=\frac{1}{a_1}+\frac{1}{a_2}+\cdots+\frac{1}{a_{10}}$.	Suppose you have a magic money machine into which you can put in any number of dollar bills. If you insert *n* dollars, the machine returns $2n$ dollars. Each time you use the machine however, you must insert more money than you did the previous time. If you start with \$1 and use the machine once, you will have \$2. The next time you use the machine you must insert \$2 yielding \$4, and on the third use of the machine you can insert either \$3 or \$4 yielding a total of \$7 or \$8. Notice there is no way that you can obtain exactly \$3 or \$5 or \$6 by using the machine repeatedly starting with \$1. Find the largest amount of money it is impossible to obtain exactly with the magic money machine, starting with \$1.
Question 15 Solve each of the following: a) Factor the following polynomial x^4+x^2+1 b) Find all solutions in $[0,2\pi)$ to the equation $\cos(x)+\sin(2x)=0$ c) Let $f(x)=ae^{bx}$, $f(1)=3$ and $f(3)=6$. Find *a* and *b*. d) What is the period of $f(x)=\cos^2(2x)$	