Grace & Macy 32 and 31 - Great job!

Extras: Basic problem → nCr explanation

2-5-22 2018 December 305

NREF

Learn: Ellipse graph characteristics from equation

- Watch Khan Academy videos

48) $2\pi + \theta =$

$\parallel$

360°

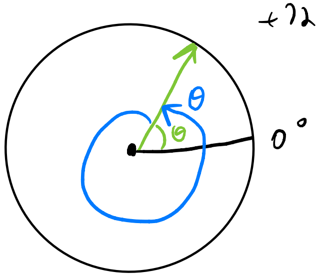
$\theta + 360^\circ = \theta$

$+720^\circ = \theta$

$\theta + 360^\circ k = \theta$

where $k \in \mathbb{Z}$

"is an integer"



radian angle measure

$\sin(2\pi + \theta) = \sin(\theta)$

dimensional analysis

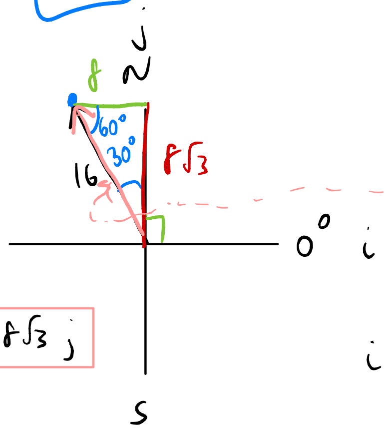
conversion factor

$\boxed{\dfrac{\pi}{180^\circ}}$ $\dfrac{2\pi}{360^\circ}$

$\dfrac{\cancel{\pi}}{2} \times \dfrac{180^\circ}{\cancel{\pi}} = 90^\circ$ $\dfrac{\cancel{\pi}}{4} \times \dfrac{180^\circ}{\cancel{\pi}} = 45^\circ$

$60\cancel{^\circ} \times \dfrac{\pi}{180\cancel{^\circ}} = \dfrac{\pi}{3}$ $30\cancel{^\circ} \times \dfrac{\pi}{180\cancel{^\circ}} = \dfrac{\pi}{}$

Trig 51)



$\boxed{-8i + 8\sqrt{3}j}$

$i = \begin{pmatrix} 1 \\ 0 \end{pmatrix}\begin{matrix} x \\ y \end{matrix}$ $j = \begin{pmatrix} 0 \\ 1 \end{pmatrix}\begin{matrix} x \\ y \end{matrix}$

$\xrightarrow{1}$ $1\uparrow$

30-60-90

i	j	
8	$8\sqrt{3}$	16
1	$\sqrt{3}$	2

$-8 \cdot i + 8\sqrt{3} \cdot j$

$-8\begin{pmatrix} 1 \\ 0 \end{pmatrix} + 8\sqrt{3}\begin{pmatrix} 0 \\ 1 \end{pmatrix} = \begin{pmatrix} -8 \\ 0 \end{pmatrix} + \begin{pmatrix} 0 \\ 8\sqrt{3} \end{pmatrix} = \begin{pmatrix} -8 \\ 8\sqrt{3} \end{pmatrix}$

$f = x+1 \qquad g = \sqrt{x}$

$\neq$ $(f \circ g)(x) = \sqrt{x}\,(x+1)$

$(f \circ g)(x) = f(g(x)) = \sqrt{x}+1$

Composition of functions

5a) $f(x) = \sqrt[3]{x} - 2$

$g(x) = x+1$

$(f \circ g)(x) = f(g(x)) = \sqrt[3]{x+1} - 2$

$(g \circ f)(x) = g(f(x)) = \sqrt[3]{x} - 2 + 1 = \sqrt[3]{x} - 1$

58)

How many ways to group

$4C2 = \binom{4}{2} = \frac{4!}{2!\,2!} = 6$

nCr on calculator

$nP_r = \frac{n!}{(n-r)!} \qquad nC_r = \binom{n}{r} = \frac{n!}{r!\,(n-r)!}$

order unimportant

"divide out by order"

$\frac{2 \text{ lines}}{6 \text{ lines}} = \frac{1}{3}$

59) $c^2 = a^2 + b^2 - 2ab\cos C$

$x^2 = a^2 + b^2 - 2ab\cos C$

c side
C is opposite angle

If solving for x, we don't know what C, the opposite angle is $\Rightarrow$ impossible

Analyze equation after class

$10^2 = x^2 + 14^2 - 2(14)x\cos(34^\circ)$

12 books, 5 math, 3 sci-fi, 2 cook books, 1 environment, 1 miscellaneous topic.

All books of same topic must be together.

How many arrangements?

| 5 | 4 | 3 | 2 | 1 | | 3 | 2 | 1 | | 2 | 1 | | | | |

How many ways to order big groups? $5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$

5 choices first group, 4 for second, 3 for third . . .

$5! \cdot 5! \cdot 3! \cdot 2! \cdot 1! \cdot 1!$

30) Put in calculator → done

1 2 3 4 5 6 0 0 0 0 0 0 0 0 0

shorter 1.23456×10^{14}

$3.8 \times 10^5 + 0.64 \times 10^5$ ↓10 ↑16

$\boxed{4.44 \times 10^5}$

32) $350 \cancel{mi} \times \dfrac{\cancel{gal}}{32 \cancel{mi}} \times \dfrac{\$4}{\cancel{gal}} = \boxed{\$43.75}$

conversion factors

$\dfrac{32 \text{ mi}}{\text{gal}}$

$\dfrac{\$4}{\text{gal}}$

57)

$$x \cdot \underbrace{1.2 \cdot 1.3 \cdot 0.8} = 1.25 \quad \boxed{C}$$

How to solve system of eqs. in calc

4b)

$$b + c = 2700$$
$$0.18b + 0.15c = 441$$

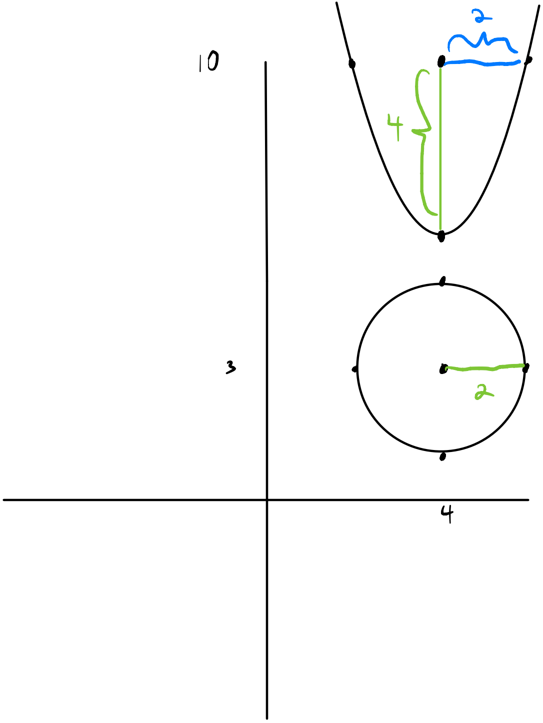
$$\left(\begin{array}{cc|c} 1 & 1 & 2700 \\ .18 & .15 & 441 \end{array}\right)$$

2×3 augmented matrix

reduced row echelon form rref

$b = 1200$
$c = 1500$

60)



$$\frac{(x-4)^2}{4} + \frac{(y-10)^2}{16} = 1$$

$$= \frac{(x-4)^2}{2^2} + \frac{(y-10)^2}{4^2} = 1$$

minor axis major axis

$$(x-4)^2 + (y-3)^2 = 4 = 2^2$$

Want: $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

Note: For this ellipse, the minor axis is parallel to the x-axis because the smaller denominator is under x.

Why does this make sense?

Conversely, the major axis is parallel to the y-axis because the larger denominator is under y.

This could be reversed.

Application of matrix

$\boxed{\text{rref algorithm:}}$

$$\begin{matrix} x+2y+3z=4 \\ 3x+4y+z=5 \\ 2x+y+3z=6 \end{matrix} \Longleftrightarrow \left(\begin{array}{ccc|c} 1 & 2 & 3 & 4 \\ 3 & 4 & 1 & 5 \\ 2 & 1 & 3 & 6 \end{array}\right) \xrightarrow{r_2-3r_1} \left(\begin{array}{ccc|c} 1 & 2 & 3 & 4 \\ 0 & -2 & -8 & -7 \\ 2 & 1 & 3 & 6 \end{array}\right) \xrightarrow{r_3-2r_1} \left(\begin{array}{ccc|c} 1 & 2 & 3 & 4 \\ 0 & -2 & -8 & -7 \\ 0 & -3 & -3 & -2 \end{array}\right)$$

$$\xrightarrow{r_2\cdot(-\frac{1}{2})} \left(\begin{array}{ccc|c} 1 & 2 & 3 & 4 \\ 0 & 1 & 4 & 7/2 \\ 0 & -3 & -3 & -2 \end{array}\right) \xrightarrow{r_3+3r_2} \left(\begin{array}{ccc|c} 1 & 2 & 3 & 4 \\ 0 & 1 & 4 & 7/2 \\ 0 & 0 & 9 & 17/2 \end{array}\right) \xrightarrow{r_3\cdot(\frac{1}{9})} \left(\begin{array}{ccc|c} 1 & 2 & 3 & 4 \\ 0 & 1 & 4 & 7/2 \\ 0 & 0 & 1 & 17/18 \end{array}\right)$$

To get last 3 zeroes, r_2-4r_3; r_1-3r_3; r_1-2r_2. Done.