B. 1) THETA $\frac{5!}{2!}$ = **60** different arrangements

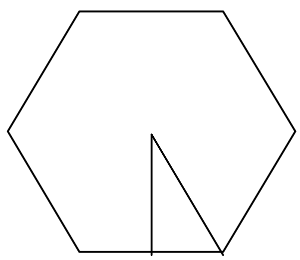
D. 2) $x^2 - x - 20 =$ (x-5)(x+4) Roots are 5, -4 $5^2 + (-4)^2 =$ **41**

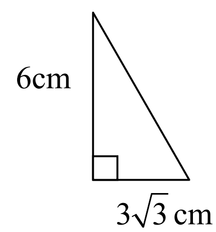
A. 3) Factor expression.

$$\frac{\left(\frac{(x+3)(x-2)}{(x)(x-4)(x+1)}\right)\left(\frac{(x-5)(x+1)}{(x+3)}\right)}{\frac{(x-2)}{2x(x-4)}} \qquad \frac{\left(\frac{\cancel{(x+3)}\cancel{(x-2)}}{\cancel{(x)}\cancel{(x-4)}\cancel{(x+1)}}\right)\left(\frac{(x-5)\cancel{(x+1)}}{\cancel{(x+3)}}\right)}{\frac{\cancel{(x-2)}}{2\cancel{x}\cancel{(x-4)}}}$$

$$= \frac{(x-5)}{\frac{1}{2}} = \mathbf{2x\text{-}10}$$

D. 4) Apothem = 6cm.

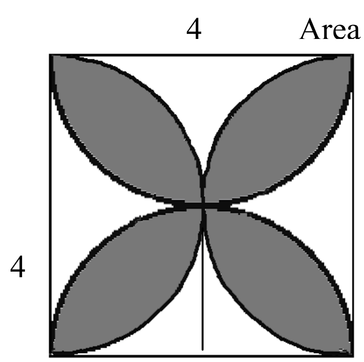




Side = $6\sqrt{3}$ cm
6* $6\sqrt{3}$ cm = $36\sqrt{3}$ **cm**

B. 5) Rearrange numbers {3, 1, 4, 1, 5, 9, 2, 6, 5} {1, 1, 2 ,3 ,4, 5, 5, 6, 9} Median = **4**

B. 6. Find the area of shaded region



2= radius of semicircle

Area of Semicircles - Area of Square = Area of Shaded Region

$$4\left(\frac{1}{2}(4\pi)\right) - 16 = 8\pi - 16$$

OR

(Area of Semicircle- Area of triangle) *4

$$\frac{1}{2}(4\pi) - 4 = 2\pi - 4$$
$$4(2\pi - 4) = 8\pi - 16$$

B. 7) 288 = $2^5 \cdot 3^2$ To find the number of positive integral factors add +1 to each power. 5+1=6, 2+1=3 (6)(3)= **18** positive integral factors
(1, 2, 3, 4, 6, 8, 9, 12, 16, 18, 24, 32, 36, 48, 72, 96, 144, 288)

C. 8) Plug in -1

$$5x^3 + 2x^2 + x + 8$$
$$5(-1)^3 + 2(-1)^2 + (-1) + 8$$
$$-5 + 2 - 1 + 8 = \mathbf{4}$$

Use Synthetic Division

-1	5	2	1	8
		-5	3	-4
	5	-3	4	**4**

D. 9.

The Radii are (from innermost to outermost) 1, 2, 3, 4, 5.

$$\left(5^2 - 4^2 + 3^2 - 2^2 + 1^2\right)\pi = (25 - 16 + 9 - 4 + 1)\pi = \mathbf{15\pi}$$

A. 10) By definition the medians of a triangle intersect at a point called the **centroid**.

D. 11) Standard form of a circle: $(x-h)^2 + (y-k)^2 = r^2$ where $(h,k) = center, r = radius$

plug in center (2,-6) and radius 4 to get $\mathbf{(x-2)^2 + (y+6)^2 = 16}$

B. 12) length, width, and height is $x+10, x+7, x$ respectively

$\frac{2}{3}x = 144$ cubic inches of cake $144/\frac{2}{3} = 216$ cubic inches of cake originally

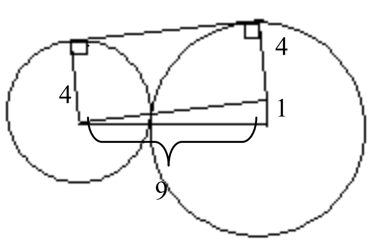
$(x+10)(x+7)(x) = 216$, **x=2 height=2 inches**

D. 13. $\left(\sqrt{x+19}\right)^2 = (x-1)^2$

$$x + 19 = x^2 - 2x + 1$$
$$x^2 - 3x - 18 = (x-6)(x+3) = 0$$

$x = 6, -3$ -3 is extraneous **6 only**

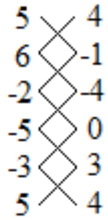
B. 14)



$$\sqrt{9^2 - 1^2} = \sqrt{80} = \mathbf{4\sqrt{5}}$$

E. 15) Only IV.0 is rational. The others are non-real or irrational. **IV Only**

B. 16) (5, 4), (6,-1), (-2,-4), (-5, 0) and (-3, 3). Use Shoelace



$(-5)+(-24)+(0)+(-15)+(-12)=-56$

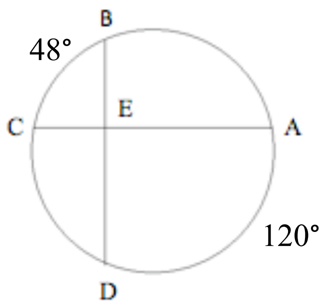
$24+2+20+0+15=61$

$\frac{|(-56)-61|}{2} = \mathbf{58.5}$

C. 17) If $216_7 = X_9$. Convert 216_7 to base 10. $7^0(6)+7^1(1)+7^2(2)=111$

Convert to base 9. $\frac{111}{9^2} = \mathbf{1}R30$ $\quad \frac{30}{9^1} = \mathbf{3}R3$ $\quad \frac{3}{9^0} = \mathbf{3}R0$ $\quad 111_{10} = \mathbf{133_9}$

D. 18.



$\angle AED = \frac{(120^\circ + 48^\circ)}{2} = 84^\circ$

$\angle CED = 180^\circ - \angle AED = 180^\circ - 84^\circ = \mathbf{96^o}$

E. 19. $(4x-3)^5$ 4^{th} term = $(5C3)(4^2)((-3)^3) = (10)(16)(-27) = \mathbf{-4320}$

A. 20. The sides 9, 12,15 form a right triangle.

Use Tangents, x=radius

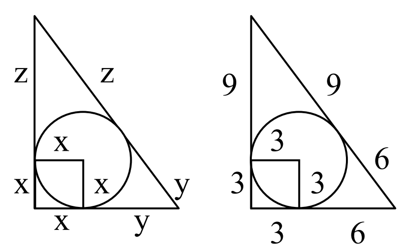
$x+y=9$

$x+z=12$

$y+z=15$

$x=3,\ y=6,\ z=9$

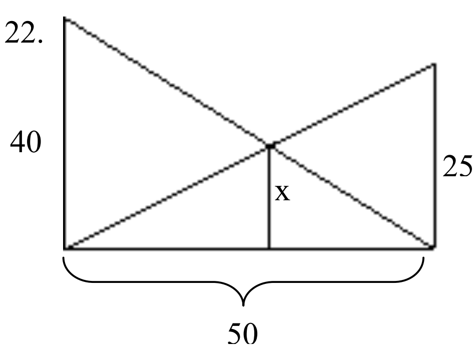
$3 = radius,\ (3^2)\pi = \mathbf{9}$



B. 21) $y=2x^2+4x+7 \rightarrow$ vertex form: $y = 2(x+1)^2+5$; vertex$\mathbf{(-1, 5)}$

Parabola has a positive x^2 value. Parabola opens up, **5**=minimum y value

E. 22.



$\frac{1}{40}+\frac{1}{25}=\frac{1}{x}$

$\frac{13}{200}=\frac{1}{x}$ $\quad x = \mathbf{\frac{200}{13}}$

E. 23. The five Platonic solids are: Tetrahedron, Cube (Hexahedron), Octahedron, Dodecahedron, Icosahedron. All A-D are Platonic Solids. **E. NOTA**

A. 24. $\frac{2}{5}+\frac{1}{5}+\frac{1}{10}+\ldots$ (First Term) / Ratio = Sum $\frac{\frac{2}{5}}{\frac{1}{2}}=\left(\frac{2}{5}\right)2=\mathbf{\frac{4}{5}}$

E. 25)

$$f(x)=x^2+9,\ g(x)=x-4$$
$$f(g(x))=45=(x-4)^2+9$$
$$x^2-8x+25=45\rightarrow x^2-8x-20\rightarrow(x-10)(x+2)$$
$$\mathbf{x=\{10,-2\}}$$

B. 26) $\frac{1}{12}+\frac{1}{10}+\frac{1}{8}=\frac{1}{X}\ \rightarrow\ \frac{10+12+15}{120}=\frac{1}{X}\ \rightarrow\ \frac{37}{120}=\frac{1}{X}$ $\mathbf{X=\frac{120}{37}}$

C. 27) 7^{2009}

Units digits: 7, 9, 3, 1, 7, 9, 3, 1, 7…. (Numbers repeat every
Powers (7^n): 1, 2, 3, 4, 5, 6, 7, 8, 9... set of four numbers)

$\frac{2009}{4}=502R\mathbf{1}$, $\mathbf{7}^1=7\rightarrow$ **units digit=7**

C. 28).

$$5x-4y=41$$
$$-3x-y=-11$$

$$5x-4y=41$$
$$(+)\ -4(-3x-y=-11)$$
$$17x=85,\ \mathbf{x=5}$$

$$5(5)-4(y)=41$$
$$41-25=16=-4y,\ \mathbf{y=-4}$$
$$x+y=5-4=\mathbf{1}$$

D. 29) 432! (divide number by powers of 5)

$\frac{432}{5}=86R2$ $\frac{432}{25}=17R7$ $\frac{432}{125}=3R57$ *Ignoring remainders*: $86+17+3=$ **106 zeroes**

C. 30). This is known as **Fermat's** Last Theorem