Mu Alpha Theta February Regional

Algebra 2 Answer Key

Individual Answers

1) B	11) D	21) C
2) C	12) D	22) E
3) C	13) E	23) C
4) D	14) C	24) A
5) C	15) B	25) C
6) B	16) C	26) D
7) A	17) B	27) C
8) C	18) A	28) B
9) A	19) B	29) B
10) A	20) C	30) B

Team Answers

1) 100
2) 12
3) 12:17
4) 1
5) 30
6) $\frac{64}{45}$
7) 14
8) 43
9) 43
10) 8
11) -2
12) 2002
13) 421
14) 5
15) -378

1) $x^{99}+x^{97}+\ldots+x^3+x^1$ divided by $x+1$ has remainder

$(-1)^{99}+(-1)^{97}+\ldots+(-1)^3+(-1)^1$

B

2) (i) T: all rational numbers are real

(ii),(iii) T,T: all numbers can be expressed in the form $a+bi$, even if $b=0$.

(iv) F: if $b\neq 0, a+bi\notin\mathbb{R}$

(i), (ii), and (iii) are true

C

3) $(1+i)^2-(1-i)^2=$

$[(1+i)+(1-i)][(1+i)-(1-i)]=$

$2(2i)=4i$

C

4) $2002=2^1\cdot 7^1\cdot 11^1\cdot 13^1$

$(1+1)^4=16$

D

5) $1+3+9+\ldots<1\times 10^6$

$3^0+3^1+3^2+\ldots+3^{n-1}>1\times 10^6$

$\frac{3^0(1-3^n)}{1-3}>1\times 10^6$

$n>13.20\rightarrow 14$

C

6) $a^2-14a+49=0$

$(a-7)^2=0$

$a=7$ is a double root

B

7) Each of 5 rings has 11 possible positions: 10 fingers, or not worn at all $\rightarrow 11^5$ total ways

A

8) Definition of Parabola

C

9) $(x-y)^2=x^2-2xy+y^2$

$=x^2+2xy+y^2-4xy$

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

$=7-4(3)=-5$

A

10) $6s+r=119$

$\frac{20}{6}(6s)+5.5r=485.5$

$s=13,\ r=41$ regular-price sold

A

11) $m(r-s)-2m(r+s)=m-2r$

$m[r-s-2(r+s)-1]=-2r$

$m=\frac{-2r}{-r-3s-1}=\frac{2r}{r+3s+1}$

$\frac{1}{m}=\frac{r+3s+1}{2r}=\frac{1}{2}+\frac{3s+1}{2r}$

D

12) Different rates:

$\text{average}=\frac{2(45)(65)}{45+65}=53.\overline{18}$

$\frac{53.\overline{18}}{55}\approx 97\%\rightarrow 3\%$ less time

D

13)

$\begin{vmatrix}2 & -6\\ -3 & y\end{vmatrix}=$

$2y-(-3)(-6)=4$

$2y=22$

$y=11\rightarrow 1+1=2$

E

14)

$15\text{ engineers}=\frac{3}{2}(10000\text{ engineers})$

$10000\text{ processors}=5(2000\text{ processors})$

$\text{will take }\frac{3}{2}(5)=\frac{15}{2}\text{ times as long}$

$\frac{15}{2}(6\text{ hours})=45\text{ hours}$

C

15) $h(x)=g\circ f(x)$

$=2\left(3x+\frac{27}{4}\right)^2-\frac{9}{8}$

$=18x^2+81x+90$

$=9(2x+5)(x+2)$

$h(a)=9(2a+5)(a+2)$

B

16) Vertices: $(1,4)$, $(-4,-1)$, $(6,1)$

$$A=\frac{1}{2}bh=\frac{1}{2}(6-(-4))(4-(-1))$$

$$=\frac{1}{2}(10)(5)=25$$

C

17) $\Psi(7\Xi 6)=6+7(7-6)=13$,
so whole expression =
$13+8(8-13)=-27$

B

18)
work & private only = 15-12=3
work & state only = 38-12=26
private & state only = 100-12=88
private only = 115-3-88-12=12
state only = 160-88-26-12=34
work only = 50-26-3-12=9
remaining = 200-12-34-9-88-26-3-12=16 = 8% of 200

A

19) 1st and 3rd $\equiv 9y-9z=-2$
1st and 2nd $\equiv -9y+10z=6$

$$z=4\rightarrow 9y-36=2\rightarrow y=\frac{34}{9}$$

$$x-2\left(\frac{34}{9}\right)+4(4)=6\rightarrow -\frac{22}{9}$$

$$(x,y,z)=\left(-\frac{22}{9},\frac{34}{9},4\right)$$

B

20) $y=2^x$ and $y=x^2$ intersect at $(2,4)$, $(4,16)$, and $\sim(-.767,.588)$

C

21) $r=\frac{k}{lj^2}$

$$1=\frac{k}{100(15)^2}\rightarrow k=22500$$

$$\frac{1}{2}=\frac{22500}{l(10)^2}\rightarrow l=450$$

C

22)
I) F: odd-ordered polynomials can only have an odd # of real roots
II) F: even-ordered polynomials can only have an even # of real roots
III) T: j^{th} ordered polynomials can have any # (up to j) real roots

$\therefore$ III only

E

23) $x^3-3x^2-25x+75=0$
$(x-5)(x+5)(x-3)=0$
$x=5,-5,3$
$x^2=25,9\rightarrow 25+9=34$

C

24) hypotenuse connects $(0,2)$ to $(4,0)$

$$\text{midpoint}=\left(\frac{0+4}{2},\frac{2+0}{2}\right)=(2,1)$$

$$\text{slope}=\frac{2-0}{0-4}=-\frac{1}{2}$$

$$\perp \text{ bisector slope}=-\frac{1}{-1/2}=2$$

$\perp$ bisector: $y-1=2(x-2)$
$(7,11)$ lies on the line

A

25) $x\log(x\log(x\log\ldots=100$
$x\log 100=100$
$2x=100\rightarrow x=50$

C

26)

$$\left(\frac{m^2}{n^{-3}}\right)^{-1}\cdot\left(\frac{3m^{-2}}{n^{-2}}\right)^{-2}=\left(\frac{n^{-3}}{m^2}\right)\cdot\left(\frac{n^{-4}}{9m^{-4}}\right)$$

$$=\frac{n^{-7}}{9m^{-2}}=\frac{m^2}{9n^7}$$

D

27) $z^2<2002$
$-44.744<z<44.744$
$-44\le\lceil z\rceil\le 45$
$-44+(-43)+\ldots+44+45=45$

C

28)

$$d_1=\frac{\ln\left(\frac{10}{7}\right)+\left(.05+\frac{.4^2}{2}\right)\left(\frac{3}{12}\right)}{.4\sqrt{\frac{3}{12}}}\approx 1.946$$

$$d_2=1.946-.4\sqrt{\frac{3}{12}}\approx 1.746$$

$c(1.946)=.974$, $c(1.746)=.960$

$$w=10(.974)-7e^{-.05\left(\frac{3}{12}\right)}(.960)=3.103\approx 3$$

B

29) $T=T_0e^{-rt}$
$90=97e^{-r(3-2)}\rightarrow r\approx .075$
$80\ge 97e^{-.075(t_f-2)}$
$t_f\approx 2.573$ (4:34:21pm)
Next quarter-hour is 4:45pm

B

30) $24x^2+144x-384<0$
$x^2+6x-16<0$
$(x+8)(x-2)<0$
$-8<x<2$
$x=-7,-6,-5,-4,-3,-2,-1,0,1$
(9 values)

B