Name: Date:
Teacher: Class/Period:

1) The first term of an arithmetic sequence is −15, and the constant difference is d_1. The first term of another arithmetic sequence is 75, and its constant difference is d_2. If the 10th terms of both sequences are the same, what must be true about d_1 and d_2 ?

A. $d_1 - d_2 = 10$

B. $d_1 - d_2 = 9$

C. $d_1 + d_2 = 10$

D. $d_1 + d_2 = 9$

2) In a geometric sequence where $a_1 = 15$ and $a_5 = 240$, what is the first term in the sequence that is a multiple of 4 ?

A. $a_2 = 20$

B. $a_3 = 60$

C. $a_4 = 60$

D. $a_4 = 120$

3) Find the 100th term of this arithmetic sequence.

5, 8, 11, 14, 17, ...

A. 302

B. 305

C. 308

D. 311

4) An arithmetic sequence has a constant difference of $3b$ and a first term of y. The nth term has a value of 24. What is the value of n ?

A. $\frac{24-y}{3b}$

B. $\frac{24-y}{3b}+1$

C. $\frac{1}{3b}(\log\frac{24}{y})$

D. $\frac{1}{3b}(\log\frac{24}{y})+1$

5) Iman starts with \$1 on Day 1 and then doubles her money every day thereafter. On which day will she first have more than \$10,000 ?

A. Day 15

B. Day 14

C. Day 10

D. Day 6

6) Given an arithmetic sequence in which $a_1 = 3$, $a_5 = 19$, and $a_n = 163$, what is n ?

A. 38

B. 39

C. 40

D. 41

7) In a given geometric sequence with n terms, 2 and 8 are the 2nd and 6th terms, respectively. What is the value of n if $32\sqrt{2}$ is the last term of the sequence?

A. 8

B. 9

C. 10

D. 11

8) This table shows some terms of an arithmetic sequence. The sum of the first n terms is 2,464. What is the nth term?

n	1	2	3	4	5	6	7
a_n		19			31		39

A. 601

B. 143

C. 139

D. 62

9) On the first of every month, a new library receives a new shipment of 575 book titles. If the library starts the beginning of the first year with 3,000 book titles and does receive a shipment that month, how many book titles will it have at the end of 3 years?

A. 42,900

B. 23,700

C. 5,363

D. 4,150

10) What is the sum of the arithmetic sequence x, y, z in terms of x and y ?

A. $3y$

B. $x + y + \frac{y^2}{x}$

C. $2y - x$

D. y^3

11) For the arithmetic sequence $\{a_n\}$, $a_5 = 12$ and $a_8 = 75$. Find the sum of the first ten terms.

A. 225

B. 435

C. 549

D. 1065

12) In the first year, the tuition at a local college is $4,000. If the tuition increases by $600 per year, how much will tuition be in the tenth year?

A. $10,600

B. $10,000

C. $ 9,400

D. $ 8,800

13) In her garden, Ginny is creating a brick mosaic in a trapezoidal shape. The mosaic pattern has 6 rows. The first row has 8 bricks, and the last row has 24 bricks. Given that Ginny's pattern follows an arithmetic sequence, how many bricks does she need?

(Note: Partial bricks are allowed.)

A. 112

B. 96

C. 64

D. 38

14) Aidan and Fenny are each creating a trapezoidal brick patio in their gardens. In total, Aidan uses twice the number of bricks that Fenny uses. The first row of Fenny's pattern has 9 bricks. The last row in Fenny's pattern has 25 bricks, with n rows. Given that this pattern follows an arithmetic sequence, how many bricks are in Aidan's garden?

A. $2n$

B. $17n$

C. $34n$

D. $68n$

15) A career advisor tells Ming that a financial consultant has a $43,000 salary for the first year, and each year thereafter receives a 3% increase in salary from the previous year. If Ming takes a job as a financial consultant, what will be her salary for the 35th year?

A. $ 86,860

B. $ 88,150

C. $117,472

D. $120,996

16) Hsiang plans to save all of his earnings for 4 years so that he can buy a used car after he graduates from high school. He receives $5 for the first week, and earns a $0.10 increase per week for 2 years, and then a $0.15 increase per week for the last 2 years. What is the total amount Hsiang will have after 4 years ?

(Note: There are 52 weeks in a year.)

A. $3,465.80

B. $3,211.00

C. $2,402.40

D. $1,315.50

17) Harold is starting a new workout program in which each day he will complete 4 more push-ups than the day before. If he starts with 5 push-ups on the 1st day, how many push-ups will he do on the 12th day?

A. 44

B. 48

C. 49

D. 53

18) The starting salary for a teacher in one school district is $32,000. He receives the same percentage raise each year and makes $38,038 during his eighth year. To the nearest tenth of a percent, what is the rate of increase of his salary each year?

A. 2.0%

B. 2.4%

C. 2.5%

D. 2.7%

19) A total of $9,100 in prizes is awarded to the top 8 entries in a science project contest. The highest prize is $2,000. The differences between successive prizes are equal. What is the amount, in dollars, of the lowest prize?

A. $200

B. $275

C. $425

D. $650

20) Evaluate $\sum_{x=1}^{10}(7-2x)$.

A. -8

B. -13

C. -40

D. -80

21) Evaluate $\sum_{n=11}^{30}(n^3+2)$.

A. 216,285

B. 213,240

C. 211,909

D. 25,669

22) Use sigma notation to represent this sum.

$$32 + 35 + 38 + \ldots + 101$$

A. $\sum_{n=34}^{11}(3n-1)$

B. $\sum_{n=11}^{34}(3n-1)$

C. $\sum_{n=29}^{101}(n+3)$

D. $\sum_{n=32}^{101}(n+3)$

23) Determine $\sum_{n=2}^{6} n^2$.

A. 40

B. 90

C. 91

D. 400

24) LaVonda is choosing between 2 jobs. For Job A, she would earn $27,000 the first year and each year after that she would get a raise of $3,000. For Job B, she would earn $30,000 the first year and each year after that she would get a raise of 4% of the previous year's salary.

A. What is the first year during which LaVonda's salary for Job A would exceed that of Job B? Show your work, and explain the approach you used to find your answer.

B. Which year would the total amount earned since starting Job A first exceed the total amount earned since starting Job B? Show your work, and explain the approach you used to find your answer.

C. Using sequence and series formulas, what would LaVonda's yearly salary and total amount of money earned be after 20 years at Job A? What would her yearly salary and total amount of money earned be after 20 years at Job B? Show your work, and explain how you used the formulas to find your answer.

25) Given a sequence determined by $a_n = 3n - 5$, where a_1 is the first term:

A. What is the 500th term of this sequence? Show your work.

B. What is an expression in sigma notation for the sum of the first 500 terms of this sequence?

C. What is the sum of the first 500 terms of this sequence? Show your work, and explain the approach you used to find your answer.

D. What is the sum of the 501st through the 1000th terms of this sequence? Show your work, and explain the approach you used to find your answer.

Please use the space below to write your response(s) to the writing assignment provided by your teacher. If there are multiple tasks to the question, please clearly label the number or letter of each task in the column to the left of your answers. If you need additional pages for your response, your teacher can provide them.

Please write the name of the writing assignment here: _____

Task

QualityCore™

Reference Sheet for the QualityCore™ **Algebra II End-of-Course Assessment**

Equations of a Line

Standard Form	$Ax + By = C$	A, B, and C are constants with A and B not both equal to zero.
Slope-Intercept Form	$y = mx + b$	(x_1,y_1) is a point. m = slope b = y-intercept
Point-Slope Form	$y - y_1 = m(x - x_1)$	

Quadratics

Standard Form of a Quadratic Equation	$ax^2 + bx + c = 0$	a, b, and c are constants, where $a \neq 0$.
Quadratic Formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	

Conic Sections

Circle	$(x - h)^2 + (y - k)^2 = r^2$	center (h,k) r = radius	
Parabola	$y = a(x - h)^2 + k$	axis of symmetry $x = h$ directrix $y = k - \frac{1}{4a}$	vertex (h,k) focus $\left(h, k + \frac{1}{4a}\right)$
Parabola	$x = a(y - k)^2 + h$	axis of symmetry $y = k$ directrix $x = h - \frac{1}{4a}$	vertex (h,k) focus $\left(h + \frac{1}{4a}, k\right)$
Ellipse	$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$	foci $(h \pm c, k)$ where $c^2 = a^2 - b^2$, center (h,k)	
Ellipse	$\frac{(y-k)^2}{a^2} + \frac{(x-h)^2}{b^2} = 1$	foci $(h, k \pm c)$ where $c^2 = a^2 - b^2$, center (h,k)	
Hyperbola	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	foci $(h \pm c, k)$ where $c^2 = a^2 + b^2$, center (h,k)	
Hyperbola	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$	foci $(h, k \pm c)$ where $c^2 = a^2 + b^2$, center (h,k)	

Lines and Points

Slope	$m = \frac{y_2 - y_1}{x_2 - x_1}$	(x_1,y_1) and (x_2,y_2) are 2 points. m = slope M = midpoint d = distance
Midpoint	$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$	
Distance	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	

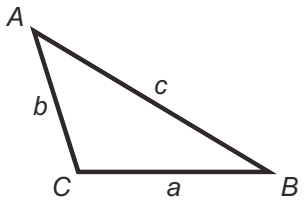
continued

Miscellaneous

Distance, Rate, Time	$D = rt$	D = distance r = rate t = time I = interest p = principal A = amount of money after t years n = number of times interest is compounded annually
Simple Interest	$I = prt$	
Compound Interest	$A = p\left(1 + \frac{r}{n}\right)^{nt}$	
Pythagorean Theorem	$a^2 + b^2 = c^2$	a and b = legs of right triangle c = hypotenuse

Laws of Sines and Cosines

Law of Sines	$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$
Law of Cosines	$a^2 = b^2 + c^2 - 2bc \cos A$



Sequences, Series, and Counting

Arithmetic Sequence	$a_n = a_1 + (n - 1)d$	$a_n = n^{\text{th}}$ term n = number of the term d = common difference s_n = sum of the first n terms r = common ratio k = number of objects in the set m = number of objects selected
Arithmetic Series	$s_n = \frac{n}{2}(a_1 + a_n)$	
Geometric Sequence	$a_n = a_1(r^{n-1})$	
Geometric Series	$s_n = \frac{a_1 - a_1 r^n}{1 - r}$ where $r \neq 1$	
Combinations	${}_kC_m = C(k,m) = \frac{k!}{(k-m)!\,m!}$	
Permutations	${}_kP_m = P(k,m) = \frac{k!}{(k-m)!}$	

Circumference, Area, and Volume

Triangle	$A = \frac{1}{2}bh$	A = area b = base h = height r = radius C = circumference d = diameter V = volume B = area of base $\pi \approx 3.14$
Parallelogram	$A = bh$	
Trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$	
Circle	$A = \pi r^2$ $C = \pi d$	
General Prism	$V = Bh$	
Right Circular Cylinder	$V = \pi r^2 h$	
Pyramid	$V = \frac{1}{3}Bh$	
Right Circular Cone	$V = \frac{1}{3}\pi r^2 h$	
Sphere	$V = \frac{4}{3}\pi r^3$	

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Answer Key

1) A
2) B
3) A
4) B
5) A
6) D
7) D
8) C
9) B
10) A
11) A
12) C
13) B
14) C
15) C
16) A
17) C
18) C
19) B
20) C
21) B
22) B
23) B

Scoring Criteria:

24)

A 4-point response may include, but is not limited to, the following points:

A. **Correct year:** Year 3

Appropriate computations used to make the decision:

Salaries		
n	Job A	Job B
1	$27,000	$30,000
2	$30,000	$31,200
3	$33,000	$32,448

Job A:
Year 2: $27,000 + $3,000 = $30,000
Year 3: $30,000 + $3,000 = $33,000

Job B:
Year 2: $30,000(1.04) = $31,200
Year 3: $31,200(1.04) = $32,448

Explanation of the approach used to find the answer: For Job A, I started with $27,000 and added $3,000 each year. For Job B, I started with $30,000, and multiplied by 1.04 to get the salary for each successive year. Year 3 is the first year for which the salary for Job A exceeds the salary for Job B.

NOTE: Students could also use the formulas for arithmetic and geometric series.

B. **Correct year:** Year 5

Appropriate computations used to make the decision:

Salaries and Totals				
n	Job A	Total (Job A)	Job B	Total (Job B)
1	$27,000	$27,000	$30,000	$30,000
2	$30,000	$57,000	$31,200	$61,200
3	$33,000	$90,000	$32,448	$93,648
4	$36,000	$126,000	$33,745.92	$127,393.92
5	$39,000	$165,000	$35,095.76	$162,489.68

Job A:
Year 4: $33,000 + $3,000 = $36,000
Year 5: $36,000 + $3,000 = $39,000

Totals:
Year 2: $27,000 + $30,000 = $57,000
Year 3: $57,000 + $33,000 = $90,000

Year 4: $90,000 + $36,000 = $126,000
Year 5: $126,000 + $39,000 = $165,000

Job B:
Year 4: $30,000(1.04) = $31,200
Year 5: $31,200(1.04) = $32,448

Totals:
Year 2: $30,000 + $31,200 = $61,200
Year 3: $61,200 + $32,488 = $93,648
Year 4: $93,648 + $33,745.92 = $127,393.92
Year 5: $127,393.92 + $35,095 = $162,489.68

Explanation of the approach used to find the answer: For Job A salaries, I continued to add $3,000 each year. For Job B, I continued to multiply by 1.04 to get the salary for each successive year. For both job totals, I added the Year 1 and Year 2 salaries together. For Year 3 and beyond, I added that year's salary to the sum of the previous years' salaries. Year 5 is the first year for which the total amount of money earned for Job A exceeds the total amount of money earned for Job B.

NOTE: Students could also use the formulas for arithmetic and geometric series.

C. **Job A and B salaries and totals:** Job A yearly salary = $84,000; Job A total = $1,110,000; Job B yearly salary $\approx \$63,205.48$; Job B total $\approx \$893,342.36$

Appropriate work needed to find the answer:
Job A salary: $27{,}000 + 3{,}000(20-1)$

Job A total: $\frac{20}{2}\left(27{,}000 + 84{,}000\right)$

Job B salary: $30{,}000(1.04)^{20-1}$

Job B total: $30{,}000\left(\frac{1-1.04^{20}}{1-1.04}\right)$

Explanation of how the formulas were used to find the answer: For the Job A yearly salary, I substituted 27,000 for the initial term, 3,000 for the difference, and 20 for the number of terms. For the Job A total, I substituted 20 for the number of terms, 27,000 for the initial term, and 84,000 for the final term. For the Job B yearly salary, I substituted 30,000 for the initial term, 1.04 for the ratio, and 20 for the number of terms. For the Job B total, I substituted 30,000 for the initial term, 1.04 for the ratio, and 20 for the number of terms.

Rubric:

4 **A response at this level provides evidence of thorough knowledge and understanding of the subject matter.**

- The response addresses all parts of the question or problem correctly.
- The response demonstrates efficient and accurate use of appropriate procedures.
- The explanation of strategies used in the response shows evidence of a good understanding of mathematical concepts and principles, and it does not contain any misconceptions.
- The explanation in the response is clear and coherent.

3 **A response at this level provides evidence of competent knowledge and understanding of the subject matter.**

- The response addresses most parts of the question or problem correctly.
- The response includes some minor errors but generally uses appropriate procedures accurately.
- The explanation of strategies used in the response shows some evidence of a good understanding of mathematical concepts and principles, and it contains few, if any, misconceptions.
- The explanation in the response is mostly clear and coherent.

2 **A response at this level provides evidence of a basic knowledge and understanding of the subject matter.**

- The response addresses some parts of the question or problem correctly.
- The response includes a number of errors but demonstrates some use of appropriate procedures.
- The explanation of strategies used in the response shows a little evidence of understanding of mathematical concepts and principles, but it may contain some evidence of misconceptions.
- The explanation in the response is partially clear, but some parts may be difficult to understand.

1 **A response at this level provides evidence of minimal knowledge and understanding of the subject matter.**

- The response addresses a few parts of the problem correctly, but the response is mostly incorrect.
- The response includes inappropriate procedures or simple manipulations that show little or no understanding of correct procedures.
- The explanation of strategies used in the response shows little or no evidence of understanding of mathematical concepts and principles, and it may contain evidence of significant misconceptions.
- Many parts of the explanation are difficult to understand.

0 **A response at this level is not scorable.** The response is off-topic, blank, hostile, or otherwise not scorable.

Scoring Criteria:

25)

A 4-point response may include, but is not limited to, the following points:

A. **Correct value for the 500th term:** 1495

Appropriate work needed to find the answer:
$a_{500} = 3(500) - 5 = 1500 - 5 = 1495$

B. **Correct expression:** $\sum_{n=1}^{500}(3n-5)$

C. **Correct sum:** 373,250

Appropriate work needed to find the answer:
$a_1 = 3(1) - 5 = -2$
$S_{500} = \frac{500}{2}(-2 + 1495) = 250(1493) = 373,250$

Explanation of the approach used to find the answer: I found a_1 by substituting 1 for n in the given expression. Then, I substituted $n = 500$, $a_1 = -2$, $a_{500} = 1495$ into the formula for an arithmetic series.

D. **Correct sum:** 1,123,250

Appropriate work needed to find the answer:
$a_{1000} = 3(1000) - 5 = 2995$
$S_{1000} = \frac{1000}{2}(-2 + 2995) = 500(2993) = 1,496,500$
$S_{1000} - S_{500} = 1,496,500 - 373,250 = 1,123,250$

Explanation of the approach used to find the answer: I found a_{1000} by substituting 1000 for n in the given expression. I found the sum of the first 1000 terms using the method in Part C and then subtracted the sum of the first 500 terms from the sum of the first 1000 terms.

–OR–

Appropriate work needed to find the answer:
$a_{501} = 3(501) - 5 = 1498$

Rubric:

4 **A response at this level provides evidence of thorough knowledge and understanding of the subject matter.**

- The response addresses all parts of the question or problem correctly.
- The response demonstrates efficient and accurate use of appropriate procedures.
- The explanation of strategies used in the response shows evidence of a good understanding of mathematical concepts and principles, and it does not contain any misconceptions.
- The explanation in the response is clear and coherent.

3 **A response at this level provides evidence of competent knowledge and understanding of the subject matter.**

- The response addresses most parts of the question or problem correctly.
- The response includes some minor errors but generally uses appropriate procedures accurately.
- The explanation of strategies used in the response shows some evidence of a good understanding of mathematical concepts and principles, and it contains few, if any, misconceptions.
- The explanation in the response is mostly clear and coherent.

2 **A response at this level provides evidence of a basic knowledge and understanding of the subject matter.**

- The response addresses some parts of the question or problem correctly.
- The response includes a number of errors but demonstrates some use of appropriate procedures.
- The explanation of strategies used in the response shows a little evidence of understanding of mathematical concepts and principles, but it may contain some evidence of misconceptions.
- The explanation in the response is partially clear, but some parts may be difficult to understand.

1 **A response at this level provides evidence of minimal knowledge and understanding of the subject matter.**

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- The explanation of strategies used in the response shows little or no evidence of understanding of mathematical concepts and principles, and it may contain evidence of significant misconceptions.
- Many parts of the explanation are difficult to understand.

0 **A response at this level is not scorable.** The response is off-topic, blank, hostile, or otherwise not scorable.