13 If $ae^{bt} = c$, where a, b, and c are positive, then t equals

(1) $\ln\left(\frac{c}{ab}\right)$

(2) $\ln\left(\frac{cb}{a}\right)$

(3) $\frac{\ln\left(\frac{c}{a}\right)}{b}$

(4) $\frac{\ln\left(\frac{c}{a}\right)}{\ln b}$

14 For which values of x, rounded to the *nearest hundredth*, will $\left|x^2 - 9\right| - 3 = \log_3 x$?

(1) 2.29 and 3.63

(2) 2.37 and 3.54

(3) 2.84 and 3.17

(4) 2.92 and 3.06

15 The terminal side of θ, an angle in standard position, intersects the unit circle at $P\left(-\frac{1}{3}, -\frac{\sqrt{8}}{3}\right)$. What is the value of sec θ?

(1) -3

(2) $-\frac{3\sqrt{8}}{8}$

(3) $-\frac{1}{3}$

(4) $-\frac{\sqrt{8}}{3}$

16 What is the equation of the directrix for the parabola $-8(y - 3) = (x + 4)^2$?

(1) $y = 5$

(2) $y = 1$

(3) $y = -2$

(4) $y = -6$

Use this space for computations.

17 The function below models the average price of gas in a small town since January 1st.

$G(t) = -0.0049t^4 + 0.0923t^3 - 0.56t^2 + 1.166t + 3.23$,
where $0 \leq t \leq 10$.

If $G(t)$ is the average price of gas in dollars and t represents the number of months since January 1st, the absolute maximum $G(t)$ reaches over the given domain is about

(1) \$1.60
(2) \$3.92
(3) \$4.01
(4) \$7.73

18 Written in simplest form, $\dfrac{c^2 - d^2}{d^2 + cd - 2c^2}$ where $c \neq d$, is equivalent to

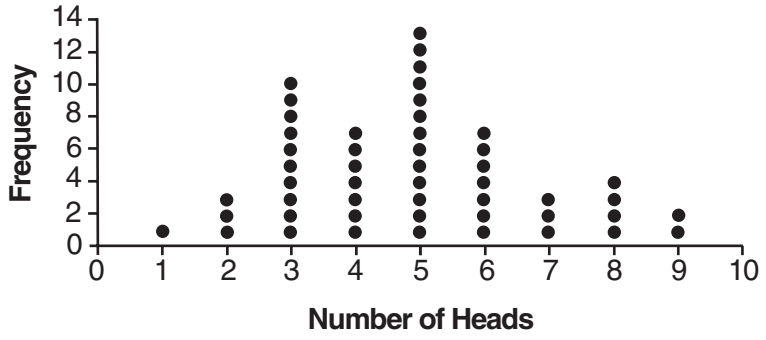
(1) $\dfrac{c + d}{d + 2c}$
(2) $\dfrac{c - d}{d + 2c}$
(3) $\dfrac{-c - d}{d + 2c}$
(4) $\dfrac{-c + d}{d + 2c}$

19 If $p(x) = 2x^3 - 3x + 5$, what is the remainder of $p(x) \div (x - 5)$?

(1) -230
(2) 0
(3) 40
(4) 240

Use this space for computations.

20 The results of simulating tossing a coin 10 times, recording the number of heads, and repeating this 50 times are shown in the graph below.



Based on the results of the simulation, which statement is *false*?

(1) Five heads occurred most often, which is consistent with the theoretical probability of obtaining a heads.

(2) Eight heads is unusual, as it falls outside the middle 95% of the data.

(3) Obtaining three heads or fewer occurred 28% of the time.

(4) Seven heads is not unusual, as it falls within the middle 95% of the data.

21 What is the inverse of $f(x) = -6(x - 2)$?

(1) $f^{-1}(x) = -2 - \frac{x}{6}$

(2) $f^{-1}(x) = 2 - \frac{x}{6}$

(3) $f^{-1}(x) = \frac{1}{-6(x - 2)}$

(4) $f^{-1}(x) = 6(x + 2)$

Use this space for computations.

22 Brian deposited 1 cent into an empty non-interest bearing bank account on the first day of the month. He then additionally deposited 3 cents on the second day, 9 cents on the third day, and 27 cents on the fourth day. What would be the total amount of money in the account at the end of the 20th day if the pattern continued?

(1) \$11,622,614.67
(2) \$17,433,922.00
(3) \$116,226,146.80
(4) \$1,743,392,200.00

23 If the function $g(x) = ab^x$ represents exponential growth, which statement about $g(x)$ is *false*?

(1) $a > 0$ and $b > 1$
(2) The y-intercept is $(0,a)$.
(3) The asymptote is $y = 0$.
(4) The x-intercept is $(b,0)$.

24 At her job, Pat earns \$25,000 the first year and receives a raise of \$1000 each year. The explicit formula for the nth term of this sequence is $a_n = 25{,}000 + (n - 1)1000$. Which rule best represents the equivalent recursive formula?

(1) $a_n = 24{,}000 + 1000n$
(2) $a_n = 25{,}000 + 1000n$
(3) $a_1 = 25{,}000,\ a_n = a_{n-1} + 1000$
(4) $a_1 = 25{,}000,\ a_n = a_{n+1} + 1000$

Part II

Answer all 8 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

25 Elizabeth tried to find the product of $(2 + 4i)$ and $(3 - i)$, and her work is shown below.

$$\begin{aligned} & (2 + 4i)(3 - i) \\ &= 6 - 2i + 12i - 4i^2 \\ &= 6 + 10i - 4i^2 \\ &= 6 + 10i - 4(1) \\ &= 6 + 10i - 4 \\ &= 2 + 10i \end{aligned}$$

Identify the error in the process shown and determine the correct product of $(2 + 4i)$ and $(3 - i)$.

26 A runner is using a nine-week training app to prepare for a "fun run." The table below represents the amount of the program completed, A, and the distance covered in a session, D, in miles.

A	$\frac{4}{9}$	$\frac{5}{9}$	$\frac{6}{9}$	$\frac{8}{9}$	1
D	2	2	2.25	3	3.25

Based on these data, write an exponential regression equation, rounded to the *nearest thousandth*, to model the distance the runner is able to complete in a session as she continues through the nine-week program.

27 A formula for work problems involving two people is shown below.

$$\frac{1}{t_1} + \frac{1}{t_2} = \frac{1}{t_b}$$

t_1 = the time taken by the first person to complete the job
t_2 = the time taken by the second person to complete the job
t_b = the time it takes for them working together to complete the job

Fred and Barney are carpenters who build the same model desk. It takes Fred eight hours to build the desk while it only takes Barney six hours. Write an equation that can be used to find the time it would take both carpenters working together to build a desk.

Determine, to the *nearest tenth of an hour*, how long it would take Fred and Barney working together to build a desk.

28 Completely factor the following expression:

$$x^2 + 3xy + 3x^3 + y$$

29 Researchers in a local area found that the population of rabbits with an initial population of 20 grew continuously at the rate of 5% per month. The fox population had an initial value of 30 and grew continuously at the rate of 3% per month.

Find, to the *nearest tenth of a month*, how long it takes for these populations to be equal.

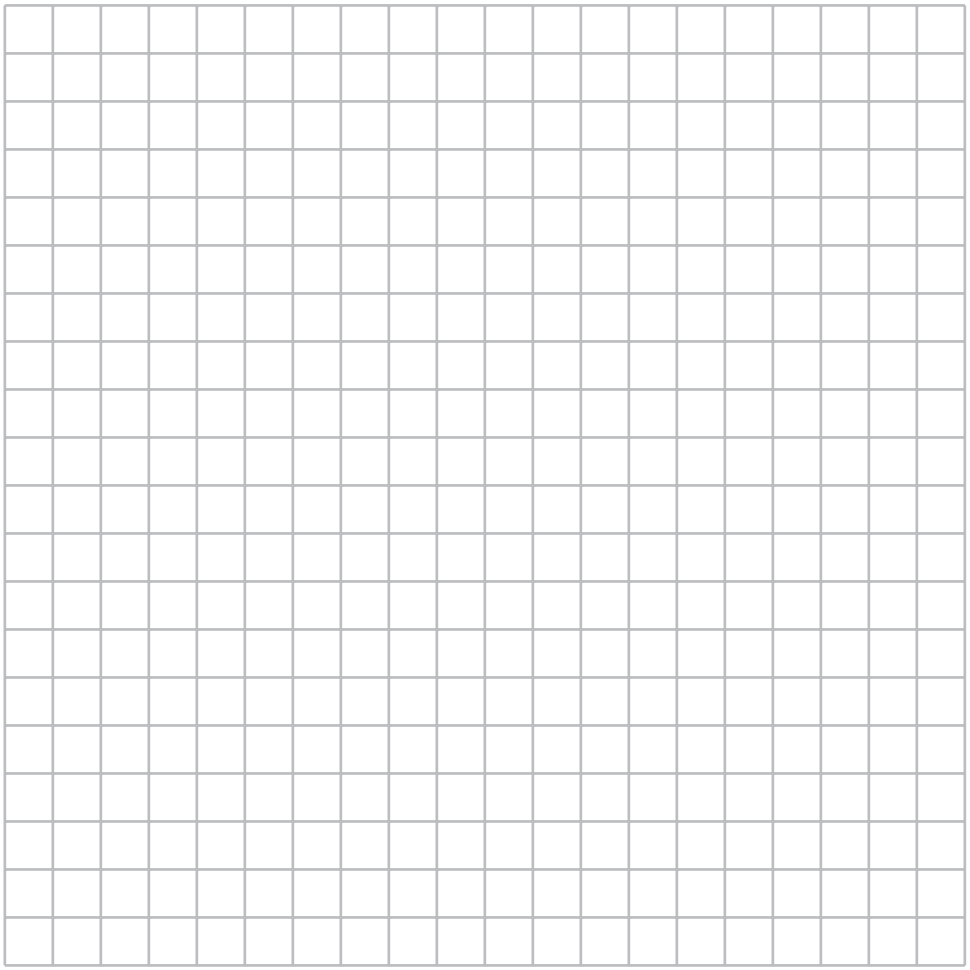
30 Consider the function $h(x) = 2\sin(3x) + 1$ and the function q represented in the table below.

x	$q(x)$
–2	–8
–1	0
0	0
1	–2
2	0

Determine which function has the *smaller* minimum value for the domain $[-2,2]$. Justify your answer.

31 The zeros of a quartic polynomial function h are -1, ± 2, and 3.

Sketch a graph of $y = h(x)$ on the grid below.



32 Explain why $81^{\frac{3}{4}}$ equals 27.