VIRGINIA STANDARDS OF LEARNING

# EOC
# ALGEBRA 2 (2023)

## 2023 Mathematics Standards of Learning

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## Practice Item Set

# Algebra 2 Formula Sheet
## 2023 *Mathematics Standards of Learning*

## Geometric Formulas:

$$A = \frac{1}{2}bh$$

$$p = 2l + 2w$$

$$A = lw$$

$$a^2 + b^2 = c^2$$
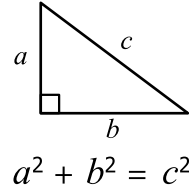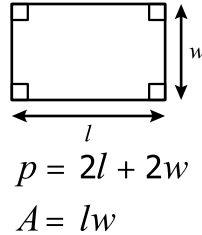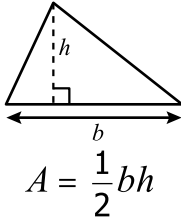
## Quadratic Formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, \text{ where } ax^2 + bx + c = 0 \text{ and } a \neq 0$$

## Statistics Formulas:

Given:

- $x$  represents an element of the data set,
- $x_i$  represents the $i^{\text{th}}$ element of the data set,
- $n$  represents the number of elements in the data set,
- $\mu$  represents the mean of the data set,
- $\sigma$  represents the standard deviation of the data set, and
- $\sigma^2$ represents the variance of the data set

**z-score:** $z = \dfrac{x - \mu}{\sigma}$

**standard deviation:** $\sigma = \sqrt{\dfrac{\sum\limits_{i=1}^{n} (x_i - \mu)^2}{n}}$

**variance:** $\sigma^2 = \dfrac{\sum\limits_{i=1}^{n} (x_i - \mu)^2}{n}$

## Permutations and Combinations Formulas:

If $n$ and $r$ are positive integers and $n \geq r$ ($n$ objects taken $r$ at a time),

$$_nP_r = \frac{n!}{(n-r)!}$$

$$_nC_r = \frac{n!}{r!(n-r)!}$$

# Standard Normal Probabilities
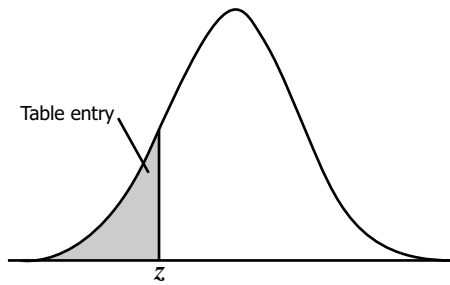


Table entry

Table entry for $z$ is the area under the standard normal curve to the left of $z$.

| z | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
|---|---|---|---|---|---|---|---|---|---|---|
| −3.4 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0002 |
| −3.3 | .0005 | .0005 | .0005 | .0004 | .0004 | .0004 | .0004 | .0004 | .0004 | .0003 |
| −3.2 | .0007 | .0007 | .0006 | .0006 | .0006 | .0006 | .0006 | .0005 | .0005 | .0005 |
| −3.1 | .0010 | .0009 | .0009 | .0009 | .0008 | .0008 | .0008 | .0008 | .0007 | .0007 |
| −3.0 | .0013 | .0013 | .0013 | .0012 | .0012 | .0011 | .0011 | .0011 | .0010 | .0010 |
| −2.9 | .0019 | .0018 | .0018 | .0017 | .0016 | .0016 | .0015 | .0015 | .0014 | .0014 |
| −2.8 | .0026 | .0025 | .0024 | .0023 | .0023 | .0022 | .0021 | .0021 | .0020 | .0019 |
| −2.7 | .0035 | .0034 | .0033 | .0032 | .0031 | .0030 | .0029 | .0028 | .0027 | .0026 |
| −2.6 | .0047 | .0045 | .0044 | .0043 | .0041 | .0040 | .0039 | .0038 | .0037 | .0036 |
| −2.5 | .0062 | .0060 | .0059 | .0057 | .0055 | .0054 | .0052 | .0051 | .0049 | .0048 |
| −2.4 | .0082 | .0080 | .0078 | .0075 | .0073 | .0071 | .0069 | .0068 | .0066 | .0064 |
| −2.3 | .0107 | .0104 | .0102 | .0099 | .0096 | .0094 | .0091 | .0089 | .0087 | .0084 |
| −2.2 | .0139 | .0136 | .0132 | .0129 | .0125 | .0122 | .0119 | .0116 | .0113 | .0110 |
| −2.1 | .0179 | .0174 | .0170 | .0166 | .0162 | .0158 | .0154 | .0150 | .0146 | .0143 |
| −2.0 | .0228 | .0222 | .0217 | .0212 | .0207 | .0202 | .0197 | .0192 | .0188 | .0183 |
| −1.9 | .0287 | .0281 | .0274 | .0268 | .0262 | .0256 | .0250 | .0244 | .0239 | .0233 |
| −1.8 | .0359 | .0351 | .0344 | .0336 | .0329 | .0322 | .0314 | .0307 | .0301 | .0294 |
| −1.7 | .0446 | .0436 | .0427 | .0418 | .0409 | .0401 | .0392 | .0384 | .0375 | .0367 |
| −1.6 | .0548 | .0537 | .0526 | .0516 | .0505 | .0495 | .0485 | .0475 | .0465 | .0455 |
| −1.5 | .0668 | .0655 | .0643 | .0630 | .0618 | .0606 | .0594 | .0582 | .0571 | .0559 |
| −1.4 | .0808 | .0793 | .0778 | .0764 | .0749 | .0735 | .0721 | .0708 | .0694 | .0681 |
| −1.3 | .0968 | .0951 | .0934 | .0918 | .0901 | .0885 | .0869 | .0853 | .0838 | .0823 |
| −1.2 | .1151 | .1131 | .1112 | .1093 | .1075 | .1056 | .1038 | .1020 | .1003 | .0985 |
| −1.1 | .1357 | .1335 | .1314 | .1292 | .1271 | .1251 | .1230 | .1210 | .1190 | .1170 |
| −1.0 | .1587 | .1562 | .1539 | .1515 | .1492 | .1469 | .1446 | .1423 | .1401 | .1379 |
| −0.9 | .1841 | .1814 | .1788 | .1762 | .1736 | .1711 | .1685 | .1660 | .1635 | .1611 |
| −0.8 | .2119 | .2090 | .2061 | .2033 | .2005 | .1977 | .1949 | .1922 | .1894 | .1867 |
| −0.7 | .2420 | .2389 | .2358 | .2327 | .2296 | .2266 | .2236 | .2206 | .2177 | .2148 |
| −0.6 | .2743 | .2709 | .2676 | .2643 | .2611 | .2578 | .2546 | .2514 | .2483 | .2451 |
| −0.5 | .3085 | .3050 | .3015 | .2981 | .2946 | .2912 | .2877 | .2843 | .2810 | .2776 |
| −0.4 | .3446 | .3409 | .3372 | .3336 | .3300 | .3264 | .3228 | .3192 | .3156 | .3121 |
| −0.3 | .3821 | .3783 | .3745 | .3707 | .3669 | .3632 | .3594 | .3557 | .3520 | .3483 |
| −0.2 | .4207 | .4168 | .4129 | .4090 | .4052 | .4013 | .3974 | .3936 | .3897 | .3859 |
| −0.1 | .4602 | .4562 | .4522 | .4483 | .4443 | .4404 | .4364 | .4325 | .4286 | .4247 |
| −0.0 | .5000 | .4960 | .4920 | .4880 | .4840 | .4801 | .4761 | .4721 | .4681 | .4641 |

# Standard Normal Probabilities

Table entry

Table entry for $z$ is the area under the standard normal curve to the left of $z$.

| z | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | .5000 | .5040 | .5080 | .5120 | .5160 | .5199 | .5239 | .5279 | .5319 | .5359 |
| 0.1 | .5398 | .5438 | .5478 | .5517 | .5557 | .5596 | .5636 | .5675 | .5714 | .5753 |
| 0.2 | .5793 | .5832 | .5871 | .5910 | .5948 | .5987 | .6026 | .6064 | .6103 | .6141 |
| 0.3 | .6179 | .6217 | .6255 | .6293 | .6331 | .6368 | .6406 | .6443 | .6480 | .6517 |
| 0.4 | .6554 | .6591 | .6628 | .6664 | .6700 | .6736 | .6772 | .6808 | .6844 | .6879 |
| 0.5 | .6915 | .6950 | .6985 | .7019 | .7054 | .7088 | .7123 | .7157 | .7190 | .7224 |
| 0.6 | .7257 | .7291 | .7324 | .7357 | .7389 | .7422 | .7454 | .7486 | .7517 | .7549 |
| 0.7 | .7580 | .7611 | .7642 | .7673 | .7704 | .7734 | .7764 | .7794 | .7823 | .7852 |
| 0.8 | .7881 | .7910 | .7939 | .7967 | .7995 | .8023 | .8051 | .8078 | .8106 | .8133 |
| 0.9 | .8159 | .8186 | .8212 | .8238 | .8264 | .8289 | .8315 | .8340 | .8365 | .8389 |
| 1.0 | .8413 | .8438 | .8461 | .8485 | .8508 | .8531 | .8554 | .8577 | .8599 | .8621 |
| 1.1 | .8643 | .8665 | .8686 | .8708 | .8729 | .8749 | .8770 | .8790 | .8810 | .8830 |
| 1.2 | .8849 | .8869 | .8888 | .8907 | .8925 | .8944 | .8962 | .8980 | .8997 | .9015 |
| 1.3 | .9032 | .9049 | .9066 | .9082 | .9099 | .9115 | .9131 | .9147 | .9162 | .9177 |
| 1.4 | .9192 | .9207 | .9222 | .9236 | .9251 | .9265 | .9279 | .9292 | .9306 | .9319 |
| 1.5 | .9332 | .9345 | .9357 | .9370 | .9382 | .9394 | .9406 | .9418 | .9429 | .9441 |
| 1.6 | .9452 | .9463 | .9474 | .9484 | .9495 | .9505 | .9515 | .9525 | .9535 | .9545 |
| 1.7 | .9554 | .9564 | .9573 | .9582 | .9591 | .9599 | .9608 | .9616 | .9625 | .9633 |
| 1.8 | .9641 | .9649 | .9656 | .9664 | .9671 | .9678 | .9686 | .9693 | .9699 | .9706 |
| 1.9 | .9713 | .9719 | .9726 | .9732 | .9738 | .9744 | .9750 | .9756 | .9761 | .9767 |
| 2.0 | .9772 | .9778 | .9783 | .9788 | .9793 | .9798 | .9803 | .9808 | .9812 | .9817 |
| 2.1 | .9821 | .9826 | .9830 | .9834 | .9838 | .9842 | .9846 | .9850 | .9854 | .9857 |
| 2.2 | .9861 | .9864 | .9868 | .9871 | .9875 | .9878 | .9881 | .9884 | .9887 | .9890 |
| 2.3 | .9893 | .9896 | .9898 | .9901 | .9904 | .9906 | .9909 | .9911 | .9913 | .9916 |
| 2.4 | .9918 | .9920 | .9922 | .9925 | .9927 | .9929 | .9931 | .9932 | .9934 | .9936 |
| 2.5 | .9938 | .9940 | .9941 | .9943 | .9945 | .9946 | .9948 | .9949 | .9951 | .9952 |
| 2.6 | .9953 | .9955 | .9956 | .9957 | .9959 | .9960 | .9961 | .9962 | .9963 | .9964 |
| 2.7 | .9965 | .9966 | .9967 | .9968 | .9969 | .9970 | .9971 | .9972 | .9973 | .9974 |
| 2.8 | .9974 | .9975 | .9976 | .9977 | .9977 | .9978 | .9979 | .9979 | .9980 | .9981 |
| 2.9 | .9981 | .9982 | .9982 | .9983 | .9984 | .9984 | .9985 | .9985 | .9986 | .9986 |
| 3.0 | .9987 | .9987 | .9987 | .9988 | .9988 | .9989 | .9989 | .9989 | .9990 | .9990 |
| 3.1 | .9990 | .9991 | .9991 | .9991 | .9992 | .9992 | .9992 | .9992 | .9993 | .9993 |
| 3.2 | .9993 | .9993 | .9994 | .9994 | .9994 | .9994 | .9994 | .9995 | .9995 | .9995 |
| 3.3 | .9995 | .9995 | .9995 | .9996 | .9996 | .9996 | .9996 | .9996 | .9996 | .9997 |
| 3.4 | .9997 | .9997 | .9997 | .9997 | .9997 | .9997 | .9997 | .9997 | .9997 | .9998 |

**1** **Which expression is equivalent to the one shown if the denominators do not equal zero?**

$$\frac{2x}{x^2 - 49} - \frac{3}{(x - 4)(x - 7)}$$

**A** $\dfrac{2x^2 - 11x - 21}{(x - 4)(x + 7)}$

**B** $\dfrac{2x^2 - 11x + 21}{(x - 4)(x - 7)}$

**C** $\dfrac{2x + 3}{(x - 4)(x + 7)}$

**D** $\dfrac{2x + 3}{x - 4}$

**2** Which expression is equivalent to the one shown if no denominators equal zero?

$$\dfrac{\dfrac{^{-}13+d}{42d^3}}{\dfrac{13-d}{6d^9}}$$

**F** $-\dfrac{7}{d^3}$

**G** $-\dfrac{d^3}{7}$

**H** $\dfrac{7}{d^6}$

**J** $-\dfrac{d^6}{7}$

**3** Which expression is equivalent to $\sqrt[3]{576\,n^8 p^{27}}$ ?

**A** $4n^2p^9\,\sqrt[3]{9n^2}$

**B** $4n^2p^3\,\sqrt[3]{9}$

**C** $24n^4p^{13}\,\sqrt[3]{p}$

**D** $192n^2p^9\,\sqrt[3]{n^2}$

**4**  Which is the factored form of $125\,m^3 - 343$ ?

**F**  $(5m - 7)^3$

**G**  $(5m - 7)(25\,m^2 + 35m + 49)$

**H**  $(5m - 7)(25\,m^2 + 70m + 49)$

**J**  $(5m - 7)(25\,m^2 - 35m - 49)$

**5**  What are the $y$-coordinates for the solutions to this system of equations?

$$\begin{cases} x^2 + 6x + 3y + 6 = 0 \\ x + y + 20 = 0 \end{cases}$$

**A**  $y = {}^-9$ and $y = 6$

**B**  $y = {}^-20$ and $y = {}^-2$

**C**  $y = {}^-26$ and $y = {}^-11$

**D**  $y = {}^-27$ and $y = {}^-18$

**6**  What is the real solution set of –

$$\frac{x}{x - 4} - \frac{4}{3} = \frac{4}{x - 4}$$

**F**  $^-4$

**G**  4

**H**  28

**J**  Ø

**7** **What is the solution set for this equation?**

$$3\sqrt{2x - 4} + 6 = 3$$

**A** $\left\{\dfrac{5}{2}\right\}$

**B** $\left\{\dfrac{1}{2}\right\}$

**C** $\left\{-\dfrac{1}{2}\right\}$

**D** $\{\ \}$

**8** **Which function is best represented by this graph?**
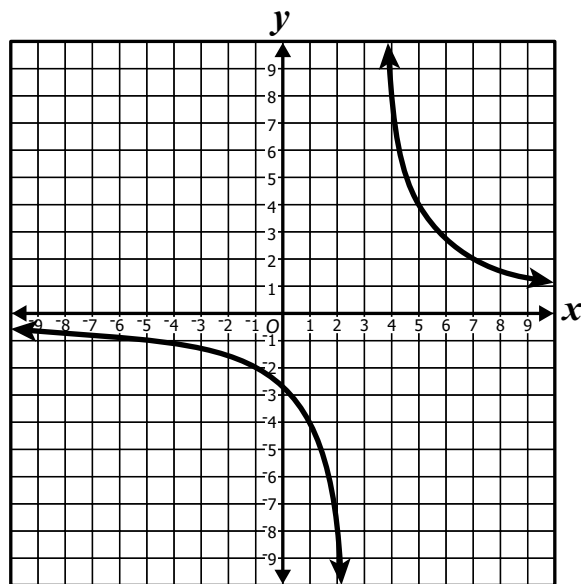


**F** $f(x) = \dfrac{8}{x + 3}$

**H** $f(x) = \dfrac{x + 1}{x + 3}$

**G** $f(x) = \dfrac{8}{x - 3}$

**J** $f(x) = \dfrac{x + 1}{x - 3}$

**9** Which graph could represent a function $g(x) = \log(x) + c$ where $c < 0$ ?

A

B

C

D
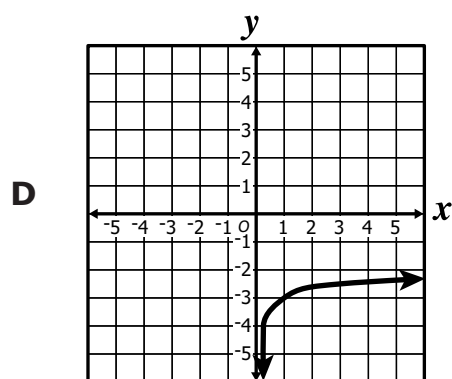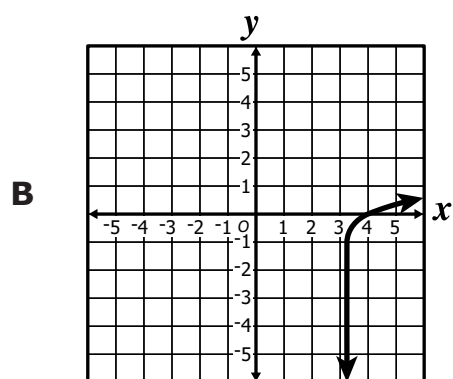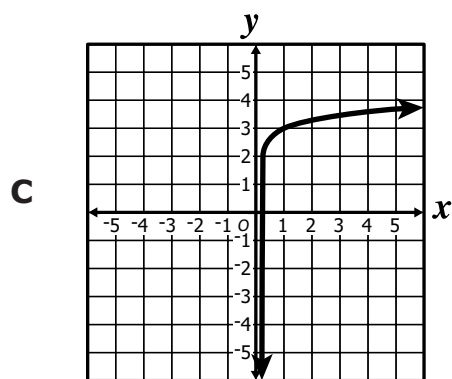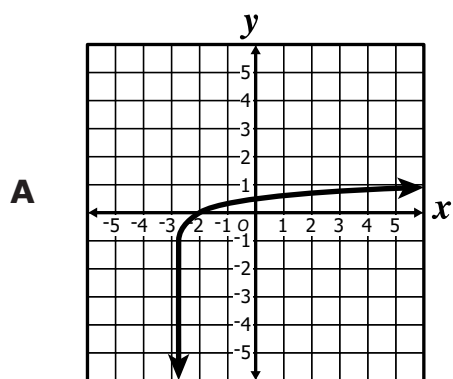
**10** An experiment is conducted on a container of gas that is kept at a constant temperature.

- **When the pressure on the gas is 30 pounds per square inch, the volume is 120 cubic inches.**
- **When the pressure on the gas is 40 pounds per square inch, the volume is 90 cubic inches.**
- **Let $p$ represent the pressure on the gas.**
- **Let $v$ represent the volume of the gas.**

**Which statement is true about this relationship?**

**F**   The volume of the gas varies directly with the pressure because $v = 4p$.

**G**   The volume of the gas varies directly with the pressure because $vp = 3{,}600$.

**H**   The volume of the gas varies inversely with the pressure because $v = 4p$.

**J**   The volume of the gas varies inversely with the pressure because $vp = 3{,}600$.

**11**  **A relation is shown in this table.**

| $x$ | $y$ |
|---|---|
| 1 | 10.00 |
| 4 | 2.50 |
| 8 | 1.25 |
| 20 | 0.50 |

**Which statement about this relation is true?**

**A**  It is a direct variation because $y = {}^-2.5x + 12.5$
**B**  It is an inverse variation because $y = {}^-2.5x + 12.5$
**C**  It is a direct variation because $10 = xy$
**D**  It is an inverse variation because $10 = xy$

**12  The graph of $g(x) = \dfrac{x + 1}{x}$ has —**

**F**  two $x$-intercepts and no $y$-intercept
**G**  two $x$-intercepts and one $y$-intercept
**H**  one $x$-intercept and no $y$-intercept
**J**  one $x$-intercept and one $y$-intercept

**13** The graph of a function is shown on the grid.
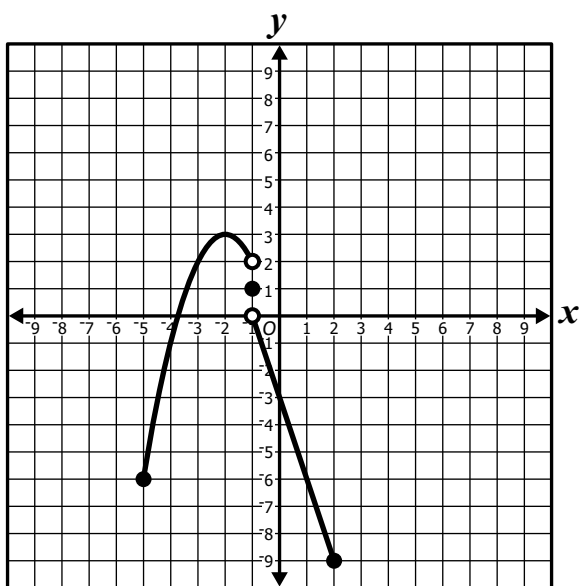


What appears to be the domain of this function?

**A** $\{x|\,{}^{-}9 \le x \le 3\}$

**B** $\{x|\,{}^{-}5 \le x \le 2\}$

**C** $\{x|\,{}^{-}5 \le x \le {}^{-}1 \text{ and } {}^{-}1 < x < 2\}$

**D** $\{x|\,{}^{-}9 \le x \le 0 \text{ and } 2 < x \le 3\}$

**14** Throughout which interval is $f(x) = {}^{-}x^3 + 2x^2 + 4x - 2$ increasing?

**F** $({}^{-}\infty, {}^{-}3]$

**G** $[{}^{-}3, 0]$

**H** $[0, 2)$

**J** $(2, \infty)$

**15** Which of the following describes the end behavior of $h(x) = \frac{x-6}{x^2}$

as $x$ approaches negative infinity?

**A** $y$ approaches negative infinity

**B** $y$ approaches $^-6$
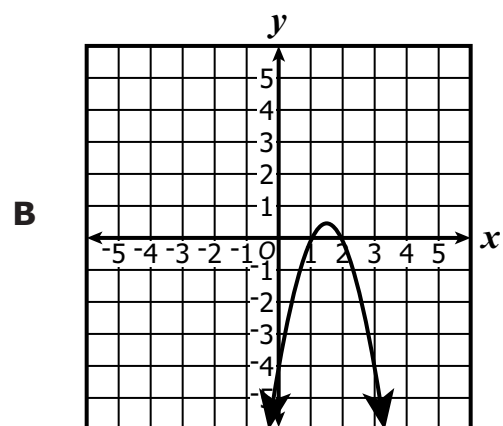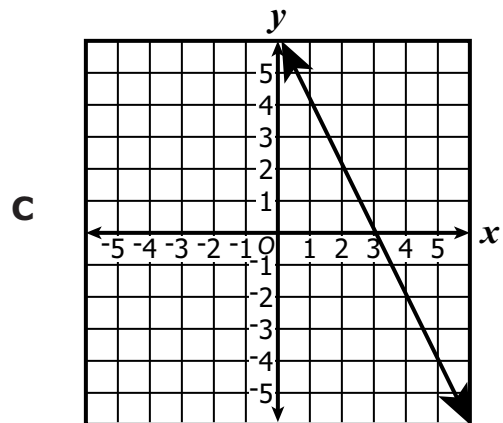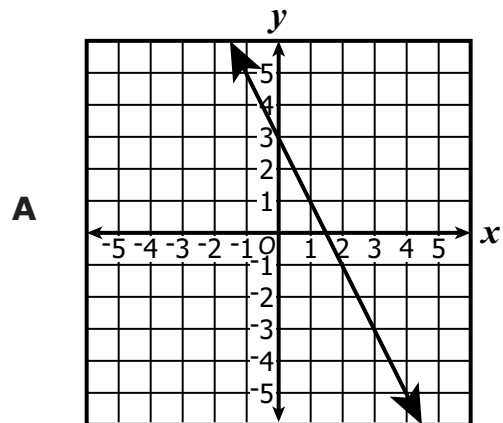
**C** $y$ approaches $^-1$

**D** $y$ approaches 0

**16** Which of the following describes the end behavior of

$f(x) = 9\log\left(\frac{2}{5}x\right) + 5$ as $x$ approaches 0 ?

**F** $f(x)$ approaches $^-\infty$

**G** $f(x)$ approaches 0

**H** $f(x)$ approaches 5

**J** $f(x)$ approaches $\infty$

**17** Given: $f(x) = x - 1$
$g(x) = {}^-2x + 4$

Which graph best represents $f(g(x))$ ?

A


C


B


D
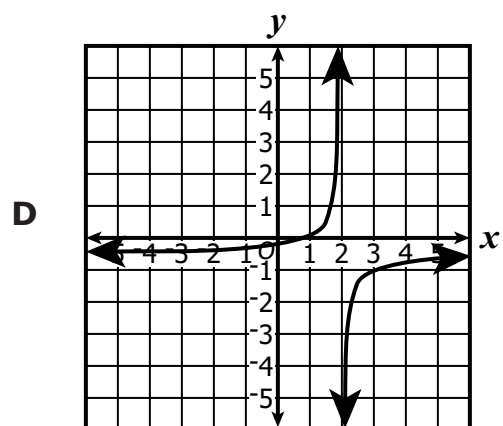
**Directions: Use the following information to answer questions 18–19.**

**The test scores of all students on the State 10th Grade English Assessment were collected and displayed in the histogram shown. The data appear normally distributed with a mean test score of 550 and a standard deviation of 82.**
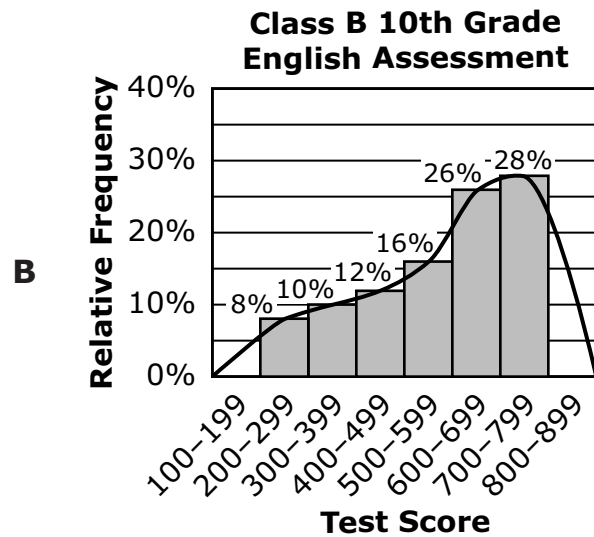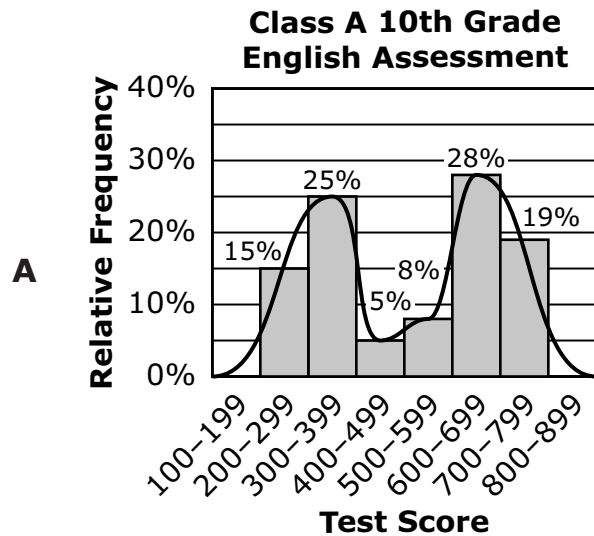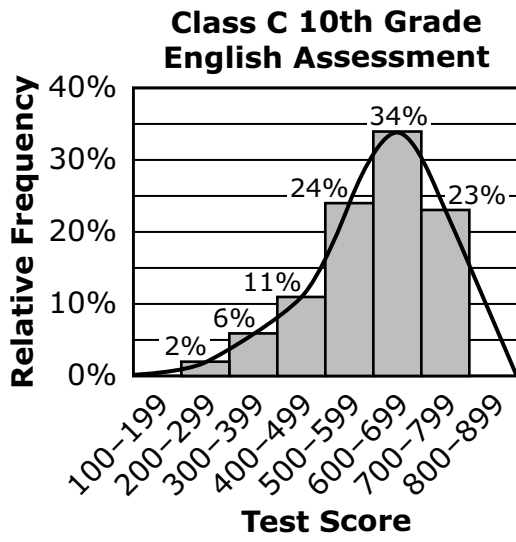
**State 10th Grade English Assessment**
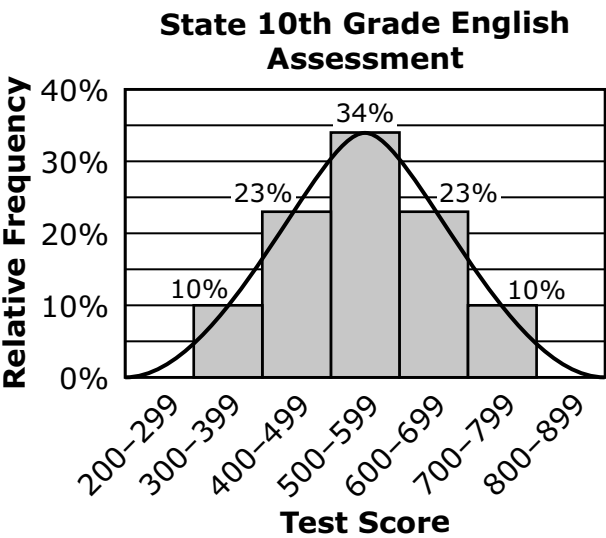
**18** **The principal of a high school in the state wants to compare the data from her school's students with the data in the histogram on the same test. To collect the most appropriate data, the principal should —**

**F** randomly poll 10th graders in her school asking them what test score they received on the State 10th Grade English assessment

**G** ask the school administration for the data files that contain all the test scores on the State 10th Grade English assessment for her school

**H** have every third 10th grader arranged alphabetically in her school report their test scores on the State 10th Grade English assessment

**J** give a questionnaire to all 10th graders in fourth-period English class asking them to provide their test score on the State 10th Grade English assessment
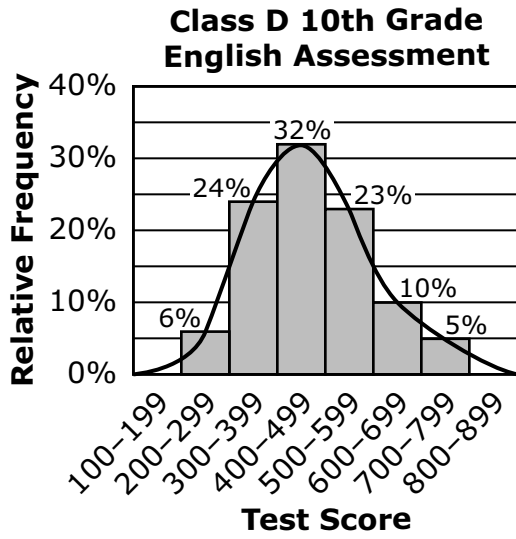
**19** The data set containing the test scores on the State 10th Grade English Assessment for Mr. Carter's English classes has a median test score lower than the median for all students. Which graph best represents the data for Mr. Carter's English classes?

**A**

**Class A 10th Grade English Assessment**

Relative Frequency (y-axis: 0%, 10%, 20%, 30%, 40%)

Test Score (x-axis: 100–199, 200–299, 300–399, 400–499, 500–599, 600–699, 700–799, 800–899)

Bar values: 15%, 25%, 5%, 8%, 28%, 19%

**B**

**Class B 10th Grade English Assessment**

Relative Frequency (y-axis: 0%, 10%, 20%, 30%, 40%)

Test Score (x-axis: 100–199, 200–299, 300–399, 400–499, 500–599, 600–699, 700–799, 800–899)

Bar values: 8%, 10%, 12%, 16%, 26%, 28%

**Class C 10th Grade English Assessment**

C



Relative Frequency

40%
30%
20%
10%
0%

34%
24%
23%
11%
6%
2%

Test Score
100–199 200–299 300–399 400–499 500–599 600–699 700–799 800–899

**Class D 10th Grade English Assessment**

D



Relative Frequency

40%
30%
20%
10%
0%

32%
24%
23%
10%
6%
5%

Test Score
100–199 200–299 300–399 400–499 500–599 600–699 700–799 800–899

——————— End of Set ———————

**20** A normally distributed set of 968 values has a mean of 108 and a standard deviation of 11. Which is closest to the number of values expected to be above 130 ?

**F** 22

**G** 155

**H** 462

**J** 946

**21** This table shows data on the amount of money raised during a fundraiser for four different classes and for one student in each class. The data is normally distributed.

**Amount of Money Raised**

|  | Mean for Class | Standard Deviation for Class | Student's z-Score |
|---|---|---|---|
| **Jill** | 60 | 11 | 1.8 |
| **Kelli** | 58 | 12 | 2.1 |
| **Monroe** | 55 | 13 | 1.4 |
| **Tim** | 57 | 10 | 2.5 |

Which of the four students raised the greatest amount of money?

**A** Jill

**B** Kelli

**C** Monroe

**D** Tim

**22** The amount of lost revenue from tickets not sold for a concert is shown in the table. The ticket prices include tax.

### Lost Revenue From Tickets Not Sold

| Price per Ticket ($x$) | $25 | $35 | $55 | $125 |
|---|---|---|---|---|
| Number of Tickets Not Sold | 84 | 80 | 92 | 323 |
| Amount of Lost Revenue ($y$) | $2,100 | $2,800 | $5,060 | $40,325 |

Which equation best models the relationship between $y$, the amount of lost revenue, and $x$, the price per ticket?

**F** $y = 1{,}218(1.01)^x$

**G** $y = 997(1.03)^x$

**H** $y = 400x - 11{,}570$

**J** $y = 156x - 10{,}000$

# EOC Algebra 2 (2023)
## Practice Item Set Spring 2025
## Answer Key

| Sequence Number | Correct Answer | Reporting Category | Reporting Category Description |
|---|---|---|---|
| 1 | C | 001 | Expressions and Operations |
| 2 | J | 001 | Expressions and Operations |
| 3 | A | 001 | Expressions and Operations |
| 4 | G | 001 | Expressions and Operations |
| 5 | C | 002 | Equations and Inequalities |
| 6 | J | 002 | Equations and Inequalities |
| 7 | D | 002 | Equations and Inequalities |
| 8 | G | 003 | Functions and Statistics |
| 9 | D | 003 | Functions and Statistics |
| 10 | J | 003 | Functions and Statistics |
| 11 | D | 003 | Functions and Statistics |
| 12 | H | 003 | Functions and Statistics |
| 13 | B | 003 | Functions and Statistics |
| 14 | H | 003 | Functions and Statistics |
| 15 | D | 003 | Functions and Statistics |
| 16 | F | 003 | Functions and Statistics |
| 17 | A | 003 | Functions and Statistics |
| 18 | G | 003 | Functions and Statistics |
| 19 | D | 003 | Functions and Statistics |
| 20 | F | 003 | Functions and Statistics |
| 21 | B | 003 | Functions and Statistics |
| 22 | G | 003 | Functions and Statistics |