0626aii

1 Which value is a zero of $a(x) = x^3 + 3x^2 - 4x - 12$?

1) -12
2) -3
3) 3
4) 0

2 Annie, Brianna, Chandra, Dee, Evan, and Fe are the six candidates running for office in Parkway High School's student organization. If Brianna and Dee are running for president and P is the set of candidates running for president, what is P', the complement of P?

1) { }
2) {Annie, Brianna, Chandra, Dee, Evan, Fe}
3) {Brianna, Dee}
4) {Annie, Chandra, Evan, Fe}

3 A man wants to have his car repaired but does not want to spend more than \$1500 for the repairs. The mechanic says that the parts needed will cost \$930 and the labor will cost an additional \$65 per hour. Which inequality could be used to find the greatest number of hours, h, the mechanic can work without exceeding this man's budget?

1) $995h \leq 1500$
2) $65 + 930h > 505$
3) $930 + 65h \leq 1500$
4) $930 + 65h > 1500$

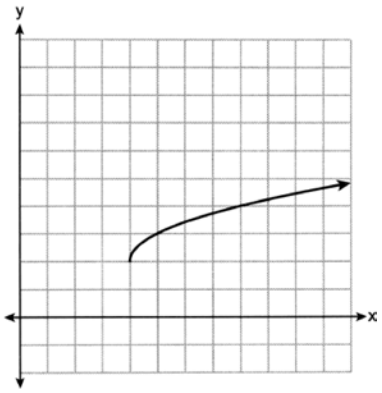
4 Given $x \neq -1$, $\frac{x^3 + 5x^2 + 2x - 8}{x + 1}$ is equivalent to

1) $x^2 + 4x + 2 - \frac{10}{x + 1}$
2) $x^2 + 6x + 8$
3) $x^2 + 6x - 4 - \frac{4}{x + 1}$
4) $x^2 + 4x - 2 - \frac{6}{x + 1}$

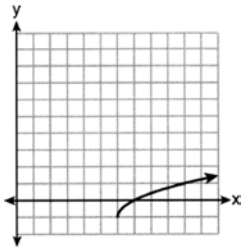
5 The expression $k^3 \bullet \sqrt[3]{8k^2}$ can be rewritten as

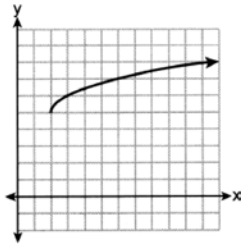
1) $2k^{\frac{11}{3}}$
2) $2k^5$
3) $24k^2$
4) $4k^{\frac{11}{3}}$

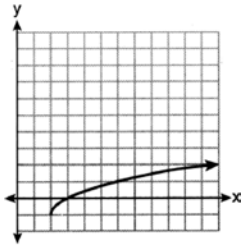
6 Consider the graph of $y = f(x)$ below.

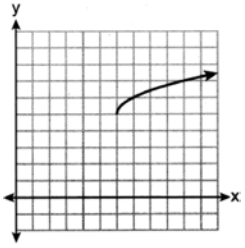


Which graph represents $y = f(x+2) - 3$?

1) 

3) 

2) 

4) 

7 What is the growth rate of the function $y = 475(1.038)^x$?

1) 1.038%
2) 0.038%
3) 3.8%
4) 38%

8 What are the solutions to the system of equations below?

$$(x-5)^2 + y^2 - 16 = 0$$
$$x + y - 9 = 0$$

1) $x = 5$ and $x = 9$
2) (5,4), only
3) (9,0), only
4) (5,4) and (9,0)

9 The sum of the first five terms of the geometric sequence 800, 600, 450, ... is

1) 253.125
2) 300
3) 2440.625
4) 2500

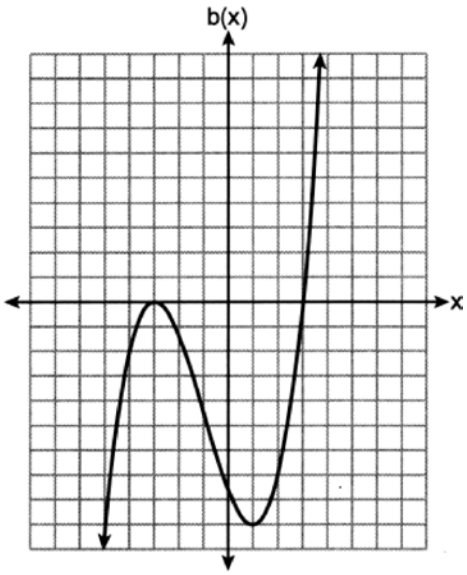
10 The number of hours per day of total screen time on electronic devices for the 3000 students at Lakeside High School is approximately normally distributed with a mean of 4.6 hours and a standard deviation of 2.5 hours. Approximately how many students at the school spent more than 5 hours per day on electronic devices?

1) 1691
2) 1309
3) 880
4) 863

11 What is the solution set to the equation $\frac{4x}{4x-3}+\frac{2}{x}=\frac{3}{4x-3}$?

1) $\{-2\}$
2) $\left\{\frac{3}{4}\right\}$
3) $\left\{-2,\frac{3}{4}\right\}$
4) $\{\ \}$

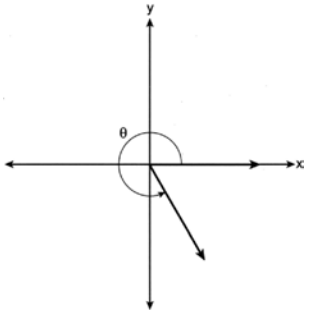
12 The cubic polynomial function $b(x)$ is graphed below.



Which statement is true for this function?

1) The leading coefficient of this function is negative.
2) A real root is repeated since it has a multiplicity greater than 1.
3) The function is increasing over the domain $-3 < x < 1$.
4) As $x \to -\infty$, $b(x) \to \infty$,

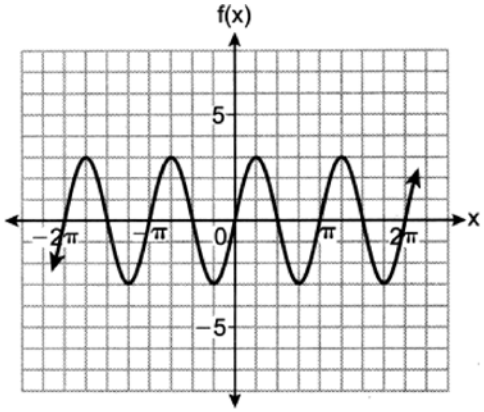
13 Consider the diagram shown below, where θ is an angle in standard position, and $0 \le \theta \le 2\pi$.



Which value could represent the radian measure of θ?

1) $\frac{5\pi}{6}$
2) $\frac{5\pi}{3}$
3) $\frac{4\pi}{3}$
4) $-\frac{\pi}{3}$

14 The graph of the sinusoidal function $f(x)$ is shown below.



The function g is defined by the equation $g(x) = 2\sin(3x)$. Which statement is true?

1) f has a greater maximum and a higher frequency than g.
2) f has a smaller maximum and a higher frequency than g.
3) f has a greater maximum and a lower frequency than g.
4) f has a smaller maximum and a lower frequency than g.

15 The expression $\left(\frac{1}{x^2}\right)^{-\frac{3}{4}}$, $x \neq 0$, is equivalent to

1) $\left(\sqrt[4]{x^2}\right)^3$
2) $\left(\sqrt[3]{x^2}\right)^4$
3) $-\left(\sqrt[4]{\frac{1}{x^2}}\right)^3$
4) $-\left(\sqrt[3]{\frac{1}{x^2}}\right)^4$

16 The expression $3xy - 27x^3y^3$ is equivalent to

1) $3xy(1 + 9x^2y^2)$
2) $3xy(1 + 9xy)(1 - 9xy)$
3) $3xy(1 + xy)(1 - xy)$
4) $3xy(1 + 3xy)(1 - 3xy)$

17 If $f(x) = (x^2 + x + 3)$ and $g(x) = (x^2 - 8x + 1)$, then $f(x) \bullet g(x)$ is equal to

1) $x^4 - 9x^3 - 4x^2 - 23x + 3$
2) $x^4 - 7x^3 + 5x^2 - 23x + 3$
3) $x^4 - 7x^3 - 4x^2 - 25x + 3$
4) $x^4 - 7x^3 - 4x^2 - 23x + 3$

18 Researchers want to see if drivers are more distracted by talking on a cell phone than talking to a passenger. From a group of 100 college students, half were randomly assigned to drive in a simulator while talking on a cell phone. The other half drove in a simulator while talking to a passenger. Researchers recorded whether or not the drivers safely exited a simulated highway at the designated exit. Is this an observational study?

1) No, because researchers randomly assigned a treatment on students.
2) Yes, because the researchers observed what students were doing while driving.
3) No, because the researchers should have randomly assigned some students to drive without taping.
4) Yes, because the students were divided into two groups of equal size.

19 If $f(x) = 3^x$, then $f^{-1}(x)$ equals

1) $\log_3(x)$
2) $\log_3(3)$
3) 3^{-x}
4) x^3

20 Given $f(x) = |x + 1| - 2$ and $g(x) = \sqrt[3]{x - 3}$, what are the solutions to the equation $f(x) = g(x)$?

1) $\{-3, 1, 3\}$
2) $\{2, 3\}$
3) $\{-5, 2\}$
4) $\{-5, 1, 2\}$

21 The expression $3xi^2 - 2yi^3 + 7xi^6 - 4yi^5$, in simplest $a + bi$ form, is

1) $-10x - 2yi$
2) $10x + 2yi$
3) $10x - 6y$
4) $4xyi^{16}$

22 Which values of a and b will make the function $f(x) = \sin(ax) + b$ an odd function?

1) $a = 1, b = 0$
2) $a = 1, b = 4$
3) $a = 3, b = 1$
4) $a = 3, b = 4$

23 When solved for x, what is the solution to the equation $a(10^x) = 60$, where $a > 1$?

1) $x = \dfrac{\log(60)}{a}$
2) $x = \dfrac{\log(60)}{\log(10a)}$
3) $x = \log(60)$
4) $x = \log\left(\dfrac{60}{a}\right)$

24 Potassium-42 is a radioisotope of potassium that has a half-life of 12.4 hours. Which expression approximates the amount of a 500-gram sample of potassium-42 remaining after t hours?

1) $500(0.1670)^t$
2) $500(0.9456)^t$
3) $500(1.0575)^t$
4) $500(1.5609)^t$

25 Given $a_1 = 5$ and $a_n = \left(a_{n-1}\right)^2 + 4$, determine a_3.

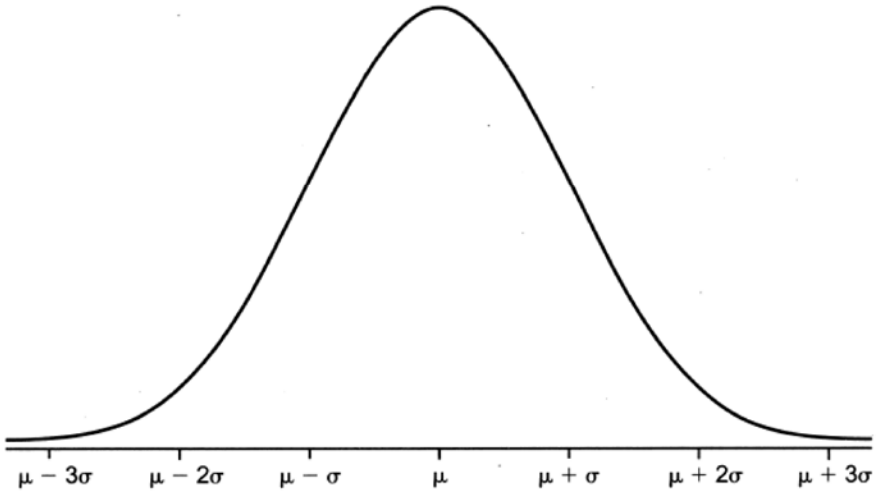
26 The table below shows the average tuition and fees for four-year colleges in the U.S. since 1970.

Years Since 1970 (x)	1	10	20	30	40	49
Tuition and Fees in Dollars (y)	5534	5099	7878	11,079	15,408	17,030

Write an exponential regression equation for this data set, rounding all values to the *nearest thousandth*.

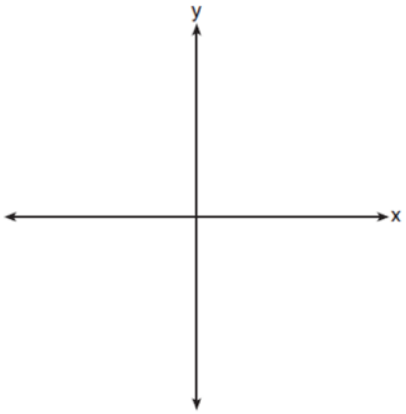
27 Given $f(x) = 3x^3 - 2x + 5$, determine the remainder when $f(x)$ is divided by $x - 2$.

28 In the U.S., the number of hours people sleep per day is approximately normally distributed with a mean of eight hours and a standard deviation of one hour. Write the seven values representing hours of sleep on the labeled increments below.



Using your values from the normal curve, state the interval centered on the mean representing approximately 68% of sleep times, in hours.

29 The zeros of a cubic polynomial function are –3, 2, and 5. There is a relative maximum of the function at (–1,9). Construct a sketch of the function on the set of axes below.



30 Given $\cos(\theta) = \frac{7}{12}$ and $\sin(\theta) < 0$, determine the exact value of $\tan(\theta)$.

31 Over the set of complex numbers, determine the roots of the equation $6x^2 + 50 = 2$ in simplest form.

32 For all the values of x for which the expression is defined, rewrite the expression below in simplest form.

$$\frac{x^3 + 64}{2x^2 + 7x - 4}$$

33 Researchers surveyed 312 American adults to see if people's ages are related to whether they prefer ebooks or print books. The survey results are summarized in the table below.

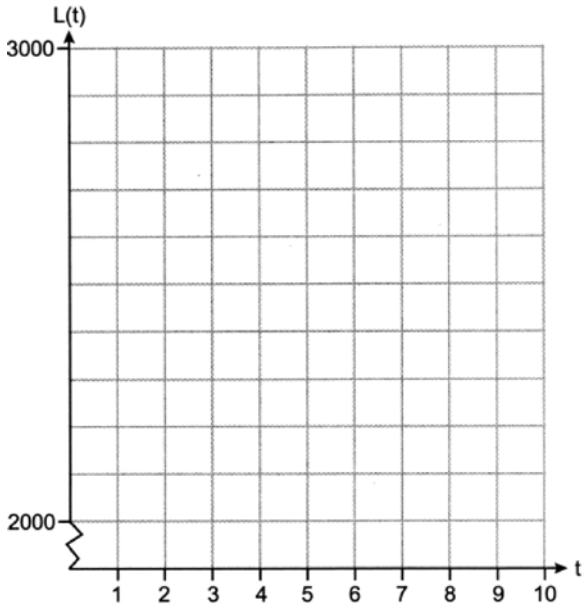
	Prefer eBooks	**Prefer Print Books**	**Total**
Ages 27-58	42	126	168
Ages 59-90	36	108	144
Total	78	234	312

Find the probability that a randomly selected adult from the survey prefers ebooks. Find the probability that a randomly selected adult from the survey prefers ebooks, given that the person is aged 27 to 58. Are the events "prefer ebooks" and "ages 27 to 58" independent? Use the survey results to justify your answer.

34 Somika opens a savings account and deposits $20,000 into the account that grows at a rate of 2.46% per year, compounded monthly. Write an exponential function, $S(t)$, that represents the amount of money in the account t years after it is opened, assuming no other money is deposited or withdrawn from the account. Algebraically calculate the number of years, to the *nearest tenth*, it will take for her account to reach $24,000.

35 Solve algebraically for x: $\sqrt{x+4} - \sqrt{3x} = -2$

36 A spirometer is used to measure lung capacity, in mL, of air while breathing. During rest, the lung capacity, L, in mL, can be approximately modeled by $L(t) = 250\sin\left(\frac{\pi}{2}t\right) + 2450$, where t is time in seconds. Graph $L(t)$ for $0 \le t \le 10$.



Use $L(t)$ to state the first time, to the *nearest tenth of a second*, on the interval $0 \le t \le 10$ when the lung capacity is 2350 mL. Determine the average rate of change, in mL per second, from $t = 3$ to $t = 5$. Explain what this means in the context of the problem.

0626aii
Answer Section

1 2

$x^3 + 3x^2 - 4x - 12 = 0$

$x^2(x+3) - 4(x+3) = 0$

$(x^2 - 4)(x+3) = 0$

$(x+2)(x-2)(x+3) = 0$

$x = -2, 2, -3$

2 4

3 3

4 4

$$x+1 \overline{)\, x^3 + 5x^2 + 2x - 8}$$

$x^2 + 4x - 2$

$x^3 + x^2$

$4x^2 + 2x$

$4x^2 + 4x$

$-2x - 8$

$-2x - 2$

-6

5 1

$k^3 \bullet \sqrt[3]{8k^2} = k^{\frac{9}{3}} \bullet 2k^{\frac{2}{3}} = 2k^{\frac{11}{3}}$

6 2

7 3

$1.038 - 1 = 0.038 = 3.8\%$

8 4

$x + y - 9 = 0$ $\quad (x-5)^2 + (-x+9)^2 - 16 = 0$ $\quad y = -(0) + 9 = 9$

$y = -x + 9$ $\quad x^2 - 10x + 25 + x^2 - 18x + 81 - 16 = 0$ $\quad y = -(5) + 9 = 4$

$2x^2 - 28x + 90 = 0$

$x^2 - 14x + 45 = 0$

$(x-5)(x-9) = 0$

$x = 5, 0$

9 3

$S_5 = \dfrac{800(1 - 0.75^5)}{1 - 0.75} = 2440.625$

10 2

$0.436 \cdot 3000 \approx 1309$

11 1

$$\frac{4x}{4x-3} + \frac{2}{x} = \frac{3}{4x-3}$$

$$\frac{4x-3}{4x-3} = -\frac{2}{x}$$

$$1 = -\frac{2}{x}$$

$$x = -2$$

12 2

$b(x)$ has a repeated zero of –3.

13 2

14 3

f: Max is 3 and frequency is $\frac{1}{\pi}$. g: Max is 2 and frequency is $\frac{3}{2\pi}$.

15 1

$$\left(\frac{1}{x^2}\right)^{-\frac{3}{4}} = \left(x^{-2}\right)^{-\frac{3}{4}} = \left(x^2\right)^{\frac{3}{4}} = \left(x^{\frac{2}{4}}\right)^3 = \left(\sqrt[4]{x^2}\right)^3$$

16 4

$$3xy - 27x^3y^3$$

$$3xy(1 - 9x^2y^2)$$

$$3xy(1 + 3xy)(1 - 3xy)$$

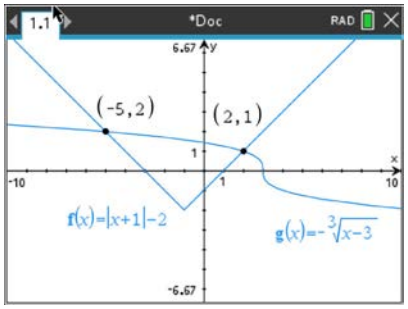
17 4

$(x^4 - 8x^3 + x^2) + (x^3 - 8x^2 + x) + (3x^2 - 24x + 3) = x^4 - 7x^3 - 4x^2 - 23x + 3$

18 1

19 1

20 3



21 1

$3xi^2 - 2yi^3 + 7xi^6 - 4yi^5 = 3x(-1) - 2y(-i) + 7x(-1) - 4yi = -3x + 2yi - 7x - 4yi = -10x - 2yi$

22 1

$y = \sin(x)$ is an odd function. After a change in the period, a, $y = \sin(x)$ is still odd. After a vertical translation, b, $y = \sin(x)$ is no longer odd.

23 4

$a(10^x) = 60$

$\log 10^x = \log \frac{60}{a}$

$x \log 10 = \log \frac{60}{a}$

$x = \log \frac{60}{a}$

24 2

$500(0.5)^{\frac{t}{12.4}} = 500\left(0.5^{\frac{1}{12.4}}\right)^t \approx 500(0.9456)^t$

25 $a_1 = 5$

$a_2 = 5^2 + 4 = 29$

$a_3 = 29^2 + 4 = 845$

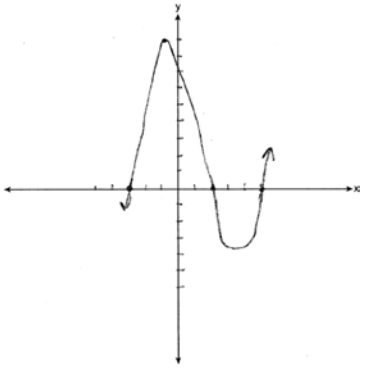
26 $y = 4686.771(1.028)^x$

27

2	3	0	-2	5
		6	12	20
	3	6	10	25

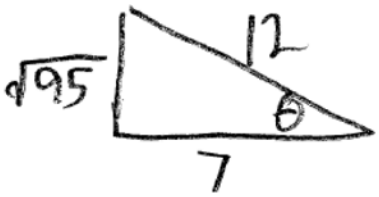
25

28 The seven values are 5, 6, 7, 8, 9, 10 and 11. The 68% interval is 7-9.



29 Prior to dilation, the function has a maximum at $(-1, 36)$.

$y = \frac{1}{4}(x+3)(x-2)(x-5)$



30 $\sqrt{12^2 - 7^2} = \sqrt{95}$ $\tan\theta = -\frac{\sqrt{95}}{7}$ $\tan\theta$ is negative because sine and cosine have opposite signs.

31 $6x^2 + 50 = 2$

$6x^2 = -48$

$x^2 = -8$

$x = \pm 2i\sqrt{2}$

32 $\dfrac{x^3 + 64}{2x^2 + 7x - 4} = \dfrac{(x+4)(x^2 - 4x + 16)}{(x+4)(2x-1)} = \dfrac{x^2 - 4x + 16}{2x - 1}$

33 $\dfrac{78}{312} = \dfrac{1}{4}$ $\dfrac{42}{168} = \dfrac{1}{4}$ Yes, because the found probabilities are equal.

34 $S(t) = 20000\left(1 + \dfrac{0.0246}{12}\right)^{12t}$

$24000 = 20000(1.00205)^{12t}$

$\dfrac{24000}{20000} = (1.00205)^{12t}$

$\log 1.2 = \log(1.00205)^{12t}$

$\log 1.2 = 12t \log(1.00205)$

$\dfrac{\log 1.2}{12\log(1.00205)} = t$

$7.4 \approx t$

35 $\sqrt{x+4} = \sqrt{3x} - 2$ 0 is extraneous.

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

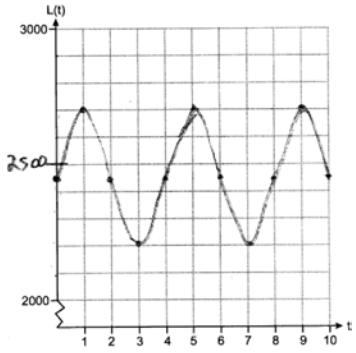
$4\sqrt{3x} = 2x$

$16(3x) = 4x^2$

$0 = 4x^2 - 48x$

$0 = 4x(x - 12)$

$x = 0, 12$

36 

2.3 seconds. $\dfrac{L(5) - L(3)}{5 - 3} = 250$, meaning from 3 seconds to 5 seconds, the lung capacity increases 250 mL/second.