

TEST SET 15- ANSWER KEYS AND SCORE CONVERSION TABLE

Module 1	1	2	3	4	5	6	7	8	9	10	11
	D	C	2	3560	6600	C	B	16	C	B	B
	12	13	14	15	16	17	18	19	20	21	22
	B	A	D	B	B	A	B	D	D	A	D
Module 2	1	2	3	4	5	6	7	8	9	10	11
	187	120	B	A	6	D	C	2	A	47.6	B
	12	13	14	15	16	17	18	19	20	21	22
	D	D	7/9	D	C	61	A	D	B	240	C

MATH SCORE COVERSION TABLE (SCALED SCORES: 200-800)

Raw Score	Scaled Score	Raw Score	Scaled Score	Raw Score	Scaled Score	Raw Score	Scaled Score
44	800	33	680	22	530	11	350
43	800	32	660	21	520	10	320
42	800	31	650	20	500	9	300
41	800	30	630	19	480	8	270
40	790	29	620	18	460	7	260
39	780	28	610	17	450	6	260
38	770	27	600	16	430	5	260
37	750	26	590	15	420	4	250
36	730	25	570	14	410	3	230
35	710	24	560	13	390	2	210
34	690	23	550	12	370	1	200

*RAW SCORE = The total number of problems correct on both module 1 (0-22) and module 2 (0-22).

Answers and explanations for Test 15 (Module 1)

1. D)

The slope of line l is $\frac{1}{3}$ based on the graph. The slope of line k is $2 \cdot \frac{1}{3} = \frac{2}{3}$ and the line k passes through a point (3, 6). So, the equation of line k will be $y = \frac{2}{3}x + 4$. Now, check the answer choice by plugging the coordinates into the equation. Then, we get the answer D).

2. C)

Factor the right side of the equation. Use difference of squares formula. $a^2 - b^2 = (a - b)(a + b)$. We can change the equation to $(\sqrt{3}x)^2 - (\sqrt{k})^2 = (\sqrt{3}x - \sqrt{k})(\sqrt{3}x + \sqrt{k})$. Therefore, the answer is C)

3. 2

Based on the graph given, find the x value which has the same y value at (4, 2). Then, the graph has the same y value at (2, 2). Therefore, the unit price is 2 dollars.

4. 3,560

He gets paid 15% of total sales and additional bonus of his pay. So, we can set up equation $587.40 = 0.15x + 0.15x \times 0.1$ or $587.40 = 1.1 \cdot (0.15x)$. then, the amount (x value) of sales he made during that period is \$3,560.

5. 6,600

Plug (200, 5,350) values into the given function, $C(x) = 350 + kx$. Then $k = 25$. So the function would be $C(x) = 350 + 25x$. Now, plug 250 into x values. Then the total cost to produce 250 calculators is \$6,600

6. C)

The standard form of a quadratic model is $y = ax^2 + bx + c$. The initial population of rabbits is 100. So $c = 100$ when substitute $x = 0$. Now, substitute (5, 300) and (12, 1,252) to find the values of a and b . Solve the following system of equations. $\begin{cases} 300 = 25a + 5b + 100 \\ 1,252 = 144a + 12b + 100 \end{cases}$ Then, you will get $a = 8$ and $b = 0$. So the quadratic equation is $y = 8x^2 + 100$. And substitute 24 (= 2years) into x values in the equation.
 $y = 8 \cdot 24^2 + 100 = 4,708$.

7. B)

The median score in class A is 8th number when you put the data in order. So, the median is 20. Now, the median score in class B is the average of 8th and 9th number when you put the data in order. So, the median is $\frac{15+20}{2} = 17.5$. therefore, the median of class B is $20 - 17.5 = 2.5$ greater than the median of class A.

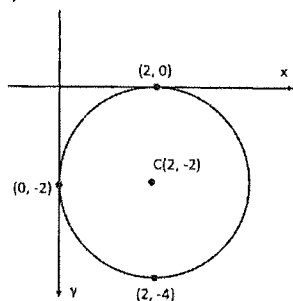
8. 16

If a quadratic equation has two real solutions, then the discriminant must be greater than zero. $b^2 - 4ac > 0 \rightarrow (-8)^2 - 4 \cdot 1 \cdot k > 0$. Then $k < 16$. And we know $k < m$. That means $m \geq 16$. So, the least possible value of m is 16.

9. C)

Max's goal is 2,000 paper cranes and he already has k paper crane. So we can set up equation $2,000 = k + \frac{60h}{5}$, where h is the number of hours for him to complete the rest of work. Now, we need to solve for h . so, $h = \frac{1}{12}(2,000 - k)$.

10. B)



The center of the circle is $C(2, -2)$ and the radius of the circle is 2. Therefore, the circle will touch y-axis at one point.

11. B)

We know the exponent formula: $(x^m y^k)^n = x^{mn} y^{kn}$. So, $\left(-3a^{\frac{1}{2}}\right)^{\frac{2}{3}} = (-3)^{\frac{2}{3}} \cdot \left(a^{\frac{1}{2}}\right)^{\frac{2}{3}}$

We also know another exponent rule: $(x^m)^n = x^{mn}$. So, $(-3)^{\frac{2}{3}} \cdot \left(a^{\frac{1}{2}}\right)^{\frac{2}{3}} = ((-3)^2)^{\frac{1}{3}} \cdot a^{\frac{1}{2} \cdot \frac{2}{3}} = \sqrt[3]{9} \cdot \sqrt[3]{a} = \sqrt[3]{9a}$.

12. B)

Multiply -5 in the first equation and multiply 2 in the second equation. Then you get $\begin{cases} -10x - 20 = -5k \\ 10x - 6y = 8 \end{cases}$. Now, add two equations vertically. Then you get $-20 - 6y = -5k + 8$. Solve for y. $y = \frac{5k-28}{6}$

13. A)

The range of $b - a$ is $60 - 80 \leq b - a \leq 130 - 20$. so $-20 \leq b - a \leq 110$. Now, we need to change the range into absolute inequalities. First, find the midpoint of the range. $\frac{-20+110}{2} = 45$. And use the general form of absolute inequality. $|x - c| \leq b$, where c is the midpoint of the range and b is positive distance between the midpoint and one of the end points of the range. Thus, $c = 45$ and $b = 110 - 45 = 65$. Finally, we get $|c - 45| \leq 65$. And we know $|a - b| = |b - a|$. So, we get $|45 - c| \leq 65$.

14. D)

The function $f(x)$ is a cube root function which has all real numbers as its domain.

15. B)

First, change $f(x)$ into the standard form and then change it again to the vertex form. $(x - 3)(x + 7) = x^2 + 4x - 21$ when you expand the f . Now, complete the square by adding $\left(\frac{b}{2}\right)^2 = \left(\frac{4}{2}\right)^2 = 4$. So, $f(x) = x^2 + 4x - 21 = (x^2 + 4x + 4) - 25 = (x + 2)^2 - 25$. And then, compare it to the $h(x) = x^2$. Therefore, $f(x)$ was formed when $h(x)$ was translated 2 units left and 25 units down.

16. B)

Use dimensional analysis. $1.5 \text{ gallon} \times \frac{128 \text{ ounces}}{1 \text{ gallon}} \times \frac{1 \text{ cup}}{8 \text{ ounces}} \times \frac{1}{8 \text{ persons}} = \frac{3 \text{ cups}}{\text{person}}$

17. A)

Let's x is the original price of the electric car Elon bought. Then, $0.8x + 0.095(0.8x) = k$ or $0.8x \cdot (1.095) = k$. Now, solve for x. then, $x = \frac{k}{(0.8)(1.095)}$.

18. B)

To show the max/min values of a quadratic function, the form of the quadratic should be the vertex form such as $f(x) = a(x - h)^2 + k$ since k will be the max/min value of the quadratic function. So, B) is the only form has the vertex form.

19. D)

Since $h(x) = 2x^4 + 4$, we know that $x^4 \geq 0$. Therefore, $h(x) \geq 4$.

20. D)

Since two lines are perpendicular, the product of two slopes is -1 . $\frac{y-0}{4-0} \cdot \frac{y-0}{4-10} = -1$.

And solve for y . then, $y = \sqrt{24} = 2\sqrt{6}$. The area of triangle OAB $= \frac{1}{2} \cdot 10 \cdot 2\sqrt{6} = 10\sqrt{6}$.

21. A)

Plug $(x - k)$ into $f(x)$. Then, $f(x - k) = 3(x - k)^2 - 12 = 3(x^2 - 2kx + k^2) - 12 = 3x^2 - 6kx + 3k^2 - 12$. This result should be equal to the right hand side of the given $f(x - k)$. Therefore, $3x^2 - 6kx + 3k^2 - 12 = 3x^2 - 12x$. So, $k = 2$.

22. D)

The graph is speed-time graph. So, the area under the curve will be the total distance traveled by the snail. The speed was constant at 4 inches per minutes during the time 1 min to 3 min. Therefore, the area of rectangle is $4 \times (3 - 1) = 8$ inches.

Answers and explanations for Test 15 (Module 2)

1. 187

$$350 \text{ sec} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{32 \text{ strokes}}{1 \text{ min}} = 186.67 \approx 187 \text{ strokes.}$$

2. 120

$$\frac{2\pi}{3} \times \frac{180^\circ}{\pi} = 120 \text{ degrees.}$$

3. B)

30% increase $\rightarrow 1+0.3 = 1.3$. The value of f will be multiplied by 1.3 every value of x increased by 1. Thus, the function should have some forms of $(1.3)^x$. Eliminate A). and Eliminate C) since $(1.3)^{-x} = \frac{1}{(1.3)^x}$. if you plug in $x=1$, $x=2$ into the answer choice B) and D), you will see only B) will increase 30% for every value of x increased by 1.

4. A)

Plug $(x-2)$ into x on $f(x)$. then $f(x-2) = (x-2-5)(x-2+2)^2 = (x-7)(x)^2$.
Now, set $(x-7)(x)^2 = 0$ and solve for x . so $x = 0$ or 7 .

5. 6

Each participant needs to build one heavy-weight and one light-weight. One heavy-weight requires 2 small wheels and 4 large wheels and one light-weight requires 1 small wheel and 2 large wheels.

1 participant $\begin{cases} 3 \text{ small wheels} \\ 6 \text{ large wheels} \end{cases}$. And there are 40 large wheels and 30 small wheels available. $30 \div 3 = 10$ and $40 \div 6 = 6.67$. so, the maximum number of participants that could attend the competition would be 6.

6. D)

One pound of barley $\rightarrow 16$ ounces of barley $\rightarrow 0.65\text{g}$ of total fat per ounce $\times 16$ ounces = 10.4 g of total fat.
One pound of brown rice $\rightarrow 16$ ounces of brown rice $\rightarrow 0.26\text{g}$ of total fat per ounce $\times 16$ ounces = 4.16 g of total fat. Thus, $10.4 - 4.16 = 6.24\text{g}$ of total fat more in barley.

7. C)

$\$90 - (\$6.50 \times 8) = \$38$ left after morning rides. Now $\$38 \div \$6.50 = 5.846$. Thus, Jimmy will need to take at least 6 rides in order to save the cost.

8. 2

$x^6 - y^6 = (x^3 - y^3)(x^3 + y^3)$. So, if you substitute the given values in the equation, $16 = 8 \cdot (x^3 + y^3)$. So $x^3 + y^3 = 2$.

9. A)

The survey was likely to be biased for the place Sarah interviewed because people in the library is highly likely to vote in favor of the proposal to get the benefit to them. And strong expressions such as "will be" or "must" are not good in the conclusion of survey. Usually, 30 is the minimum sample size but it shouldn't go over 30% of the entire population.

10. 47.6

The total number of tails on Quarters is $9+11 = 20$. The total number of tosses on Quarters is $12+9+10+11 = 42$.
Therefore, the percent of tails on Quarters is $\frac{20}{42} \times 100(\%) = 47.6\%$.

11. B)

The average speed from his home to his friend's house is $\frac{4}{2} = 2 \text{ mph}$. We should not count the times (from $t=1$ to 2) for a lunch time. And the average speed on his way back home is $\frac{4}{1} = 4 \text{ mph}$. So, the speed of running back home will be twice of the speed of walking to his friend's house.

12. D)

All of the answer choices have $(x + 3)(x - 7)$ for two x-intercepts of -3 and 7. Now, for the vertex to be farthest from the x-axis, the absolute value of the y-coordinate of the vertex should be largest to be farthest away from the x-axis. The x-coordinate of the vertex must be the midpoint of two x-intercepts. So, $h = \frac{-3+7}{2} = 2$. And substitute $x=2$ into the answer choices to see which one you get the largest absolute value of y. then the answer is D).

13. D)

Use dimensional analysis. $8.85 \text{ km} \times \frac{1,000 \text{ m}}{1 \text{ km}} \times \frac{0.768 \text{ kPa}}{100 \text{ m}} \times \frac{0.145 \text{ psi}}{1 \text{ kPa}} = 9.86 \text{ psi}$.

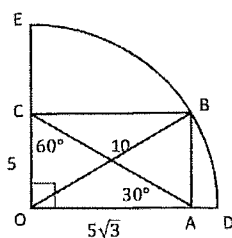
14. $\frac{7}{9}$

$\left(\frac{4xy}{3}\right) \cdot (2y)^{-2} = \left(\frac{4xy}{3}\right) \cdot \left(\frac{1}{(2y)^2}\right) = \left(\frac{4xy}{3}\right) \cdot \left(\frac{1}{4y^2}\right) = \frac{1}{3} \cdot \frac{x}{y}$. Now, we know $\frac{x}{y} = \frac{7}{3}$ from the given in the problem. Therefore, it will be $\frac{1}{3} \cdot \frac{7}{3} = \frac{7}{9}$.

15. D)

If it decreases/increases at a constant rate, it is a linear relationship. If it decreases/increases by a certain percent every unit of time, it is an exponential relationship.

16. C)



The right triangle OAC is $30^\circ - 60^\circ - 90^\circ$ triangle which has a ratio of sides $x - x\sqrt{3} - 2x$. So, $AC=10$ using the Pythagorean triple and the length of OB (The radius of the quarter circle) is also 10 because $AC=OB$ (diagonals of a rectangle are congruent). Therefore, the area of the quarter circle is $\frac{1}{4}\pi 10^2 = 25\pi$.

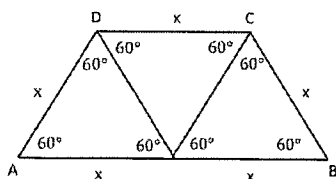
17. 61

Science classes enrollment at Valencia High School

	Male	Female	Total
Physics	65	35	100
Chemistry	45	55	100
Total	110	90	200

The percent of female students who are taking chemistry is $\frac{55}{90} \times 100 \approx 61\%$

18. A)



The half of regular hexagon can be split into 3 equilateral triangles as shown above. The perimeter of the isosceles trapezoid is 10. So, $5x = 10$. it gives $x = 2$. So the area of the isosceles trapezoid $= \frac{1}{2}(b_1 + b_2) \cdot h = \frac{1}{2}(2 + 4) \cdot \sqrt{3} = 3\sqrt{3}$.

19. D)

The function needs to be reflected by x-axis from $(x - 2)^2$ to $-(x - 2)^2$ and it needs to translate up 3 units to become $-(x - 2)^2 + 3$.

20. B)

Since the rate of water pouring in is constant, the speed of height of water level is slower toward to the top portion of the cup. So, the slope (the speed of height increase) is less steep as time goes on.

21. 240

Jeremiah's money in his piggy bank after t months: $120 + 30t$

Elliott's money in his piggy bank after t months: $40 + 50t$

And set those two expressions equal to each other for the same amount of money. Then, $120 + 30t = 40 + 50t$, $t = 4$. Therefore, the value of S is $120 + 30(4) = 240$.

22. C)

The total number of people in her class is $3 + 4 + 6 + 4 = 17$. The median is 9th number in the data when the data is in order. So, the median is 3. Eliminate d). Now, let's find the 1st quartile. It's the middle number in the first half. So, it's the average of 4th and 5th number in the list. Therefore, it is 2. The only answer choice C) has 2 as the first quartile.