TEST SET 1 - ANSWER KEYS AND SCORE CONVERSION TABLE

	1	2	3	4	5	6	7	8	9	10	11
Module 1	2	4920	D	B	B	C	C	C	B	D	4
	12	13	14	15	16	17	18	19	20	21	22
	D	29	C	790	A	6	2	B	130	B	C
Module 2	1	2	3	4	5	6	7	8	9	10	11
	2	D	D	5/11	12	D	A	C	A	C	A
	12	13	14	15	16	17	18	19	20	21	22
	B	D	A	B	C	C	D	8/3	B	C	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 1 (Module 1)

1. 2

   Square both sides of the equation. $4(x - m) = (x - m)^2$. And rearrange the equation and factor it. $0 = (x - m)((x - m) - 4)$. Then $x = m$ or $x = m + 4$. Since the greatest solution to the equation is 6 and m is the positive constant, $m + 4 = 6$. Therefore, $m = 2$.

2. 4,920

   Use dimensional analysis: $\frac{82\ data}{sec} \times \frac{60\ sec}{1\ min} = 4{,}920$ data/min.

3. D)

   Isolate y from the first equation. $y = \frac{-1-x}{-2} = \frac{x+1}{2}$. Now, plug that into the second equation. $-3 + 3x = 4\left(\frac{x+1}{2}\right) - 2$. Simplify it. $-3 + 3x = 2x + 2 - 2$. Finally, solve for x. $x = 3$. The question is the value of 2x. so, $2 \times 3 = 6$.

4. B)

   The range is the difference between minimum and maximum. So, company 2 has the largest difference between min and max.

5. B)

   Let x be the sales in 2021 and y be the sales in 2022. The percent change from 2020 to 2021 for store B is -10. So, we can set up the equation. $\frac{x-12000}{12000} \times 100 = -10$. So $x = 10{,}800$. The percent change from 2021 to 2022 is 10%. $\frac{y-10800}{10800} \times 199 = 10$. And solve for y. $y = 11{,}880$.

6. C)

   Two graphs intersect at two points. It means that the discriminant of quadratic equation after combining two equations should be greater than 0. Now, substitute the second equation into the first equation. Then, $(x^2 - 2m) + mx = 3$. Next, Simplify and put the equation in order. $x^2 + mx - 2m - 3 = 0$. Therefore, Discriminant $= b^2 - 4ac = m^2 - 4 \cdot 1 \cdot (-2m - 3) > 0$. Solve for m. $m < -6$ or $m > -2$.
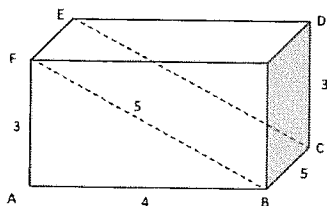
7. C)

   Let's set up an equation based on the information.
   $0.10 \times 90 + 0.10 \times 100 + 0.60 \times 87 + 0.20 \times x \geq 90$, where x is the score for the final test. Now, solve for x. then, you get $x \geq 94$. Therefore, he would need to get at least 94 on his final test in order to achieve grade A.

8. C)

   Factor GCF in the expression of $8x^3y^4 - 32x^7y^2$. Then, $8x^3y^2(y^2 - 4x^4) = 8x^3y^2(y - 2x^2)(y + 2x^2)$.

9. B)

   In the figure left, BF=5 using Pythagorean triples. Next, the area of rectangular region BCEF is $5 \times 5 = 25$.
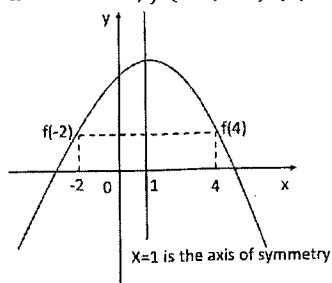
10. D)

$U - N = \frac{5\pi}{36}$. Substitute $U = \frac{\pi}{3}$ into the equation. Then, you get $N = \frac{7\pi}{36}$. Now, we multiply $\frac{180°}{\pi}$ to convert it to degrees. Therefore, $\frac{7\pi}{36} \times \frac{180°}{\pi} = 35°$.
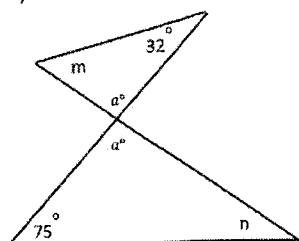
11. 4

The quadratic function has the axis of symmetry at the vertex. So, the x coordinate of the vertex is $-\frac{b}{2a} = -\frac{4}{2(-2)} = 1$. Therefore, $f(-2) = f(4)$ by axis of symmetry. Check the diagram below.

12. D)

Since vertical angles are congruent and the sum of interior angles in both triangles is 180 degrees, you can set up equation. $m + a + 32 = n + a + 75$. When you subtract a and n on both sides of the equation, you get $m - n + 32 = 75$. Now, subtract 32 on both sides again. Then, you get $m - n = 43$.

13. 29

The central angle for the entire circle is $360°$. The percent of 1st quarter is $100 - 60 - 22 - 10 = 8\%$. So, the central angle, in degrees, for 1st quarter is $0.08 \times 360° = 28.8 \cong 29°$.

14. C)

The total number of students who has a social media account is 1,230 and $6s$ stands for the number of sophomores who has a social media account. Since the school has 6 sophomore classes, s must stand for the average number of sophomores who has a social media account.

15. 790

$Sum\ of\ list\ A = 50 \times 25 = 1250$ and $Sum\ of\ list\ B = 60 \times 34 = 2040$. Therefore, the positive difference between two sums = $2040 - 1250 = 790$.

16. A)
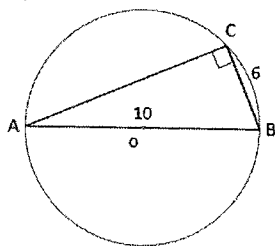
Since $\overline{AB}$ is a diameter, $m\angle ACB = 90°$ (inscribed angle of a semi-circle, $\frac{180}{2} = 90°$). And use Pythagorean triples of 3-4-5 or 6-8-10. Then the length of AC is 8. Now, the area of triangle of ABC is $\frac{1}{2} \times 8 \times 6 = 24$.

17. 6

$\frac{x(xy^2)^4}{x^4y^3} = \frac{x \cdot x^4 \cdot y^8}{x^4 \cdot y^3} = \frac{x^5 y^{8-3}}{x^4} = x^1 y^5 = x^m y^n$. Now, compare the last two expressions. Then you get $m = 1$ and $n = 5$. Therefore, $m + n = 6$.

18. 2

Substitute $x = 1$ into the given function equation. $2f(1) = f(2)$. Now, substitute $f(2) = 4$. then, $2f(1) = 4$. $f(1) = 2$.

19. B)

Multiply -4 on both sides of the first equation. Then, you get the second equation. It means that the system will have infinitely many solutions. To express the solutions to the system, you can put variable (k) either on x or on y. let's try on x first. Put k into x in the first equation. $\frac{1}{2}k - y = \frac{7}{2}$. Now, isolate the variable y. $y = \frac{k}{2} - \frac{7}{2}$. You can write the answer as $\left(k, \frac{k}{2} - \frac{7}{2}\right)$. Eliminate A). Now, let's try on y. Put k into y in the first equation again. $\frac{1}{2}x - k = \frac{7}{2}$. Multiply 2 on both sides and isolate x. $x = 2k + 7$. Now, you can write the answer $(2k + 7, k)$.

20. 130

$m\angle BAC = 50°$ because $m\angle BAC = 180° - 130°$. Since AB=BC, triangle ABC is an isosceles triangle which has two congruent base angles. $\angle BAC \cong \angle BCA$. Thus, $m\angle BCA = 50°$. Now, $\angle BCA \cong \angle y$ because vertical angles are congruent. Therefore, $m\angle y = 50°$. The measure of the vertex angle x is 80°. So, $x + y = 130°$

21. B)

Let's change the given equation to the standard form of a circle equation by completing the square. First, divide by 2 on both sides. $x^2 + 2x + y^2 - 4y = -2$. Now, use $\left(\frac{b}{2}\right)^2$ to complete the square. $x^2 + 2x + 1 + y^2 - 4y + 4 = -2 + 1 + 4$. Then, you get $(x + 1)^2 + (y - 2)^2 = 3$. Since $r^2 = 3$, the area of the circle is 3π.

22. C)

First, the slope of the line of best fit should be negative. Eliminate A) and B). and y-intercept must be positive based on the graph. Therefore, the answer is C).

Answers and explanations for Test 1 (Module 2)

1. 2

   Distribute and simplify. $-2 + 2x - 3 = ax + 1$. Collect like terms and solve for x. $x(2 - a) = 6$. $x = \frac{6}{2-a}$.
   Therefore, if $a = 2$, there would be no solution to the equation.

2. D)

   The value of k should be the coefficient of the exponential function f. and $f(-2) = k$. So, when plug $x = -2$ into the function of f(x), you should get the coefficient of the function. Only D) shows the coefficient $k = 4$ when plug $x = -2$ into the function.

3. D)

   Since she gets only hourly pay, she earns based on the hours of working. So use the proportion. $\frac{k}{t} = \frac{x}{4t+1}$. And solve for x. then, $x = \frac{4tk+k}{t} = 4k + \frac{k}{t}$.

4. $\frac{5}{11}$

   The number of workers who has at least 80 hours of field experience is 11 (count the dots right side of the vertical line $x = 80$). Now, the number of workers who could finish one project less than the expected time, in hours, is 5 (count the dots below the line of best fit). therefore, the answer is $\frac{5}{11}$.

5. 12

   Draw two radii of the circle O as follows.
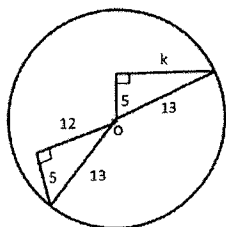
   The radius of the circle is 13 in the lower right triangle using Pythagorean triple 5-12-13. Now, the upper right triangle is congruent to the lower triangle because they have the same hypotenuse as the radii of the same circle. Therefore, $k = 12$.

6. D)

   Solve for the variables from the given equation. $x = \frac{20}{3}, y = 5, and \ z = 10$. Now, plug the values into the expression of $15xy^2z = 15 \cdot \frac{20}{3} \cdot 5^2 \cdot 10 = 25,000$.

7. A)

   We can use SOH-CAH-TOA. So, $sin\theta = \frac{56}{102}$. Now, solve for $\theta = sin^{-1}(\frac{56}{102})$.

8. C)

   Use the fundamental theorem of algebra. $ax^2 + bx + c = 0$, then the sum of two roots is $-\frac{b}{a}$ and the product of two roots is $\frac{c}{a}$. Thus, the sum is $-\frac{b}{a} = -\frac{-(m+1)}{2} = 4$. Solve for m. Then, you get $m = 7$. Now, the product of two roots is $\frac{c}{a} = \frac{2m}{2} = m = 7$.

9. A)

Since $(0, a)$ is a solution of the system of inequalities, you can plug the coordinates into both inequalities. Then, $a < 2$ and $a > -1$. Or you can write $-1 < a < 2$. So the possible value for a in the answer choices is A).

10. C)

This problem is for exponential decay. The amount of drug left in the body decreases in half every hour at a constant rate. The equation should be $y = a \left(\frac{1}{2}\right)^t$, where t is the number of hours after the drug is injected. Therefore, the correct graph is C).

11. A)

20 cm is the required measure of height with 1.5 cm margin of error. If x is the allowable height, then $18.5 < x < 21.5$. You can express this using absolute inequality such as $|x - center| < margin\ of\ error$. Therefore, $|x - 20| < 1.5$ and you should notice that $|x - 20| = |20 - x|$. The answer is A).

12. B)

First, the sum of thickness for front and back cover is $3 \times 2 = 6mm$. and the thickness of each page is 0.2mm. so the total thickness of the book would be $6 + 0.2x$.

13. D)

Since $f(x) = -(x - 1)^2 + 1, f(x) - 1 = -(x - 1)^2$. So, find the graph of $y = -(x - 1)^2$. The coordinates of the vertex of the parabola is $(1, 0)$ and opens downward because the leading coefficient is negative. Therefore, the answer would be D).

14. A)

Carpenter needs to make 4 dog houses. Each dog house require 2.9ft of wood stick. So, $4 \times 2.9 = 11.6ft$. Since the stick is sold only by the single length in feet, carpenter would need to buy 12ft. therefore, the total cost of the wood stick would be $\$2 \times 12 = \$24$.

15. B)

If the outlier is removed from the data, The range would be affected the most. And The mode would not change. And the median and the interquartile range would be barely affected.

16. C)
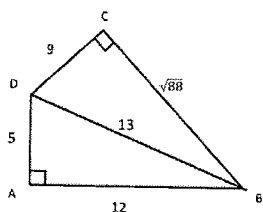
Use Pythagorean theorem to find BD. $9^2 + \sqrt{88}^2 = BD^2$. $BD = 13$. Next, use Pythagorean Triples. 5-12-13. Therefore, the length of $\overline{AD} = 5$. The area of triangle ABD is $\frac{1}{2} \times 12 \times 5 = 30$.

17. C)

Adrian saves $t - \frac{2}{5}t = \frac{3}{5}t$ every month. Now, you can set up an equation $3,600 = \frac{3}{5}t \times x \times 12$, where x is the number of years to reach the amount of $3,600. Note that you will need to multiply 12 to change years to months. Solve for x. you get $x = \frac{500}{t}$.

18. D)

In the graph of function f, $f(-2) = -4$. Thus, $f(f(-2)) = f(-4) = -2$. When you draw a horizontal line $y = -2$ in the same XY-coordinate plane, the horizontal line will intersect 3 times with the graph of $y = f(x)$.

19. $\frac{8}{3}$

Since the graph of y passes through the point $(0, 2)$, plug that point into the equation $y = a(x + 3)(x - 1)$ to find the value of a. So, $a = -\frac{2}{3}$. Use the axis of symmetry to find the value of h (x-coordinate of the vertex). $h = \frac{-3+1}{2} = -1$. Now, plug $x = -1$ into the equation to find the value of k (y-coordinate of the vertex). $k = -\frac{2}{3}(-1 + 3)(-1 - 1) = -\frac{2}{3} \cdot 2 \cdot -2 = \frac{8}{3}$.

20. B)

Let's say the price of a certain car is 100. Now, it was decreased by 10% in the first half year. So, the value of the car was 90. And then it was increased by 10% of 90. Thus, the final value of the car would be $90 + 0.10 \times 90 = 99$. Therefore, the value of the car was decreased by 1% from the beginning to the end of the year.

21. C)

Complete the square to change it to standard form of a circle. $x^2 + 6x + 9 + y^2 - 2y + 1 = -1 + 9 + 1$. It becomes $(x + 3)^2 + (y - 1)^2 = 9$. The radius of the circle is 3. Therefore, the circumference of the circle is $2\pi \times 3 = 6\pi$.

22. C)

Let's isolate the variable x in the first equation. You get $x = \frac{y+1}{2}$. Now, substitute it to the second equation. $y = \left(\frac{y+1}{2}\right)^2 - 9$. Simplify and put it in order. $y^2 - 2y - 35 = 0$. Now, the product of two y values would be $\frac{c}{a} = \frac{-35}{1} = -35$ using the fundamental theorem of algebra.