1) A person's BMI (body mass index) varies directly as an individual's weight in pounds and inversely as the **square** of the individual's height in inches. A person who weighs 118 pounds and is 64 inches tall has a BMI of approximately 20.0. Find the approximate BMI of a person who weighs 195 pounds and is 71 inches tall. Round to the nearest whole number. Hint: Round the value of k to the nearest whole number.

A $BMI = 25$
B $BMI = 27$
C $BMI = 24$
D $BMI = 26$
E $BMI = 23$

$BMI = \frac{kw}{h^2}$

$20.0 = \frac{k(118)}{64^2}$

$20 = \frac{118k}{4096}$

$20(4096) = 118k$

$81920 = 118k$

$694 = k$

$BMI = \frac{694w}{h^2}$

$BMI = \frac{694(195)}{71^2}$

$BMI = \frac{135330}{5041}$

$BMI = 26.845$ or 27

2) Given the functions $f(x) = 2x + 6$ and $g(x) = \frac{1}{2}x - 3$, which statement(s) is(are) **true**?

I The domain of $g(x) = (-\infty, 2) \cup (2, \infty)$
II $(f \circ g)(x) = x$
III $(g - f)(x) = -\frac{3}{2}x - 9$

A I, II, and III
B III only
C II and III only
D I and III only
E II only

I Any number can replace x in the function $g(x)$. The domain is all numbers $(-\infty, \infty)$. I is false.

II

$$(f \circ g)(x) = f\left(\frac{1}{2}x - 3\right)$$
$$= 2\left(\frac{1}{2}x - 3\right) + 6 \qquad \text{II is true.}$$
$$= x - 6 + 6 = x$$

III

$$(g - f)(x) = \left(\frac{1}{2}x - 3\right) - (2x + 6)$$
$$= \frac{1}{2}x - 3 - 2x - 6 \qquad \text{III is true.}$$
$$= -\frac{3}{2}x - 9$$

3) Given $f(x) = x^2 - 2$ and $g(x) = \sqrt{x+5}$, find $(f \circ g)(x)$.

A $(f \circ g)(x) = x + 3$
B $(f \circ g)(x) = x - 2$
C $(f \circ g)(x) = \sqrt{x^2 + 3}$
D $(f \circ g)(x) = x + \sqrt{3}$
E $(f \circ g)(x) = x^2 + 10x + 23$

$(f \circ g)(x) = f(g(x))$
$= f(\sqrt{x+5})$
$= (\sqrt{x+5})^2 - 2$
$= x + 5 - 2$
$= x + 3$

4) Find the inverse function of *f*, if $f(x) = \dfrac{2x-1}{x-2}$.

A $f^{-1}(x) = \dfrac{x-2}{2x-1}$
B $f^{-1}(x) = \dfrac{2x+1}{x+2}$
C $f^{-1}(x) = \dfrac{2x-1}{x}$
D $f^{-1}(x) = \dfrac{x}{2x-1}$
E $f^{-1}(x) = \dfrac{2x-1}{x-2}$

Switch the *x* and the *y*.

$x = \dfrac{2y-1}{y-2}$ Multiply both sides by denominator.

$x(y-2) = 2y - 1$
$xy - 2x = 2y - 1$
$xy - 2y = 2x - 1$
$y(x-2) = 2x - 1$
$y = \dfrac{2x-1}{x-2}$ $f^{-1}(x) = \dfrac{2x-1}{x-2}$

5) Fill in the blanks: The graph of $f(x) = 2^x$ goes through the point _____ and the graph of $g(x) = \log_2 x$ goes through the point _____. Hint: Make tables of ordered pairs.

A $(-1, 2)$, $(16, 4)$
B $\left(-1, \frac{1}{2}\right)$, $(4, 16)$
C $(1, 2)$, $(4, 16)$
D $\left(-1, \frac{1}{2}\right)$, $(16, 4)$
E $\left(1, \frac{1}{2}\right)$, $(16, -4)$

g(x) is the inverse of f(x). Reverse ordered pairs.

$f(x)$

x	$f(x)$
0	1
1	2
-1	**$\frac{1}{2}$**
2	4
3	8
4	16

$g(x)$

x	$g(x)$
1	0
2	1
$\frac{1}{2}$	-1
4	2
8	3
16	**4**

$\left(-1, \frac{1}{2}\right)$ $(16, 4)$

6) Rebecca bought a computer, monitor, and scanner costing a total of \$875 (including all taxes and fees). Full payment is deferred for two years. She will be paying 3.8% annual interest **compounded continuously**. How much does Rebecca owe at the end of the 2 years? Round to the nearest cent. Assume she makes no payments until the payment at the end of the two years.

A \$944.09

B \$941.22

C \$943.42

D \$944.98

E \$943.75

$A = Pe^{rt}$

$A = 875e^{(0.038)(2)}$

$A = 875e^{0.076}$

$A = 875(1.078962574)$

$A = \$944.09$

7) Which logarithm statement is **false**?

A $\log_{\frac{4}{3}}\left(\frac{9}{16}\right) = -2$

B $\log_4\left(\frac{1}{16}\right) = -4$

C $\ln\left(e^6\right) = 6$

D $\log 0.01 = -2$

E $\log_3\left(\frac{1}{27}\right) = -3$

Convert each to exponential form.

$\left(\frac{4}{3}\right)^{-2} = \frac{9}{16}$ true

$4^{-4} = \frac{1}{4^4} = \frac{1}{256}$ false

Using rule $\log_b b^x = x$, $\ln e^6 = 6$ true

$10^{-2} = \frac{1}{10^2} = \frac{1}{100} = 0.01$ true

$3^{-3} = \frac{1}{3^3} = \frac{1}{27}$ true

8) The percentage of adult height attained by a girl who is x years old can be modeled by $P(x) = 62 + 35\log(x-4)$. Which statement describes the percentage of her adult height for a girl of age 10? Round to the nearest tenth of a percent.

A She has attained 89.2% of her adult height.

B She has attained 97.0% of her adult height.

C She has attained 86.2% of her adult height.

D She has attained 77.8% of her adult height.

E She has attained 82.3% of her adult height.

$P(x) = 62 + 35\log(x-4)$

$P(10) = 62 + 35\log(10-4)$

$P(10) = 62 + 35\log 6$

$P(10) = 62 + 35(0.77815125)$

$P(10) = 62 + 27.23529376$

$P(10) = 89.2\%$

9) Solve this exponential equation by expressing each side as a power of the same base.

$$8^{2x-5} = 2^{4+x}$$

A $x = \frac{9}{5}$

B $x = 9$

C $x = \frac{19}{5}$

D $x = 8$

E $x = \frac{19}{7}$

$8^{2x-5} = 2^{4+x}$ $\quad 8 = 2^3$

$(2^3)^{2x-5} = 2^{4+x}$

$3(2x-5) = 4+x$

$6x-15 = 4+x$

$5x = 19$

$x = \frac{19}{5}$

10) Use the properties of logarithms to expand the logarithm below. Simplify where possible. Assume the values of x and y are positive.

$$\log\left(\frac{100x^2}{y}\right)$$

A $\frac{2\log x}{\log y}$

B $2\log x - \frac{1}{2}\log y$

C $4 + 2\log x - \log y$

D $2 + 2\log x - \log y$

E $\log 10 + 2\log x - \log y$

$\log\left(\frac{100x^2}{y}\right)$

$= \log(100x^2) - \log y$

$= \log 100 + \log x^2 - \log y$

$= 2 + 2\log x - \log y$

11) Solve: $\log x + \log(x-21) = 2$

A $x = -4,\ 25$

B $x = 25$

C $x = \frac{23}{2}$

D $x = \frac{21}{2} + \frac{\sqrt{449}}{2}$

E No solution

$\log x + \log(x-21) = 2$

$\log[x(x-21)] = 2$

$\log(x^2 - 21x) = 2$

$10^2 = x^2 - 21x$

$0 = x^2 - 21x + 100$

$0 = (x-25)(x+4)$

$x - 25 = 0 \quad x + 4 = 0$

$x = 25 \quad x = -4$

$x = 25 \quad x = -4$

Only 25 checks.

The -4 makes a negative value in an argument.

12) Solve this system of equations. What is the value **of the *y*?**

$$\begin{cases} y = 2x+4 \\ 3x+5y=-19 \end{cases}$$

A $y=-3$

B $y=0$

C $y=10$

D $y=-2$

E None of the above.

$$\begin{cases} y = 2x+4 \\ 3x+5y=-19 \end{cases}$$

It is easy to use substitution.

$3x+5(2x+4)=-19$

$3x+10x+20=-19$

$13x=-39$

$x=-3$

$y=2(-3)+4$

$y=-2$

13) A restaurant with 20 tables only has 4-seat tables and 6-seat tables. If all seats are full, the restaurant has 96 customers seated. Let *x* = the number of 4-seat tables and *y* = the number of 6-seat tables. Which system of equations could be used to find *x* and *y*?

A $\begin{cases} x+y=20 \\ 6x+4y=96 \end{cases}$

B $\begin{cases} x+y=96 \\ 6x+4y=20 \end{cases}$

C $\begin{cases} x+y=20 \\ 4x+6y=96 \end{cases}$

D $\begin{cases} x+y=96 \\ 4x+6y=20 \end{cases}$

E None of the above.

The total number of tables is 20.

$x+y=20$

4(# of 4 seat tables) + 6(number of 6 seat tables) = number of seats

$4x+6y=96$

$$\begin{cases} x+y=20 \\ 4x+6y=96 \end{cases}$$

14) What is the radius of the circle with equation below?

$$x^2+y^2-8x+6y-24=0$$

A $r=2\sqrt{6}$

B $r=\sqrt{38}$

C $r=\sqrt{74}$

D $r=2\sqrt{13}$

E $r=7$

$x^2+y^2-8x+6y-24=0$

$(x^2-8x \quad)+(y^2+6y \quad)=24$

$(x^2-8x+16)+(y^2+6y+9)=24+16+9$

$(x-4)^2+(y+3)^2=49$

$radius: \sqrt{49}$ or 7

15) Which of the following quadratic functions (parabolas) matches this information?
Opens downward, Vertex: $(-2,-3)$

A $f(x)=-2(x+2)^2+3$

B $g(x)=-x^2-6x-11$

C $p(x)=3(x+2)^2-3$

D $r(x)=-4x^2-16x-19$

E $h(x)=-\frac{1}{2}(x+3)^2-2$

The 'a' value must be negative.
Find the vertex of each function.

$f(x)=-2(x+2)^2+3$ opens down, $V(-2,3)$ NO

$g(x)=-x^2-6x-11$ opens down, $h=\frac{-(-6)}{2(-1)}=3$ $k=-9-6(3)-11=-38$

$V(3,-38)$ NO

$p(x)=3(x+2)^2-3$ opens up NO

$r(x)=-4x^2-16x-19$ opens down, $h=\frac{-(-16)}{2(-4)}=\frac{16}{-8}=-2$

$k=-4(4)-16(-2)-19=-3$ $V(-2,-3)$ YES

$h(x)=-\frac{1}{2}(x+3)^2-2$ opens down, $V(-3,-2)$ NO