ANSWER KEY: QUANTITATIVE

Section 1. Fundamental Operations.

1. *Ans. C. 1 - a.*

$$1-\cfrac{1}{1-\cfrac{1}{1-\cfrac{1}{1-a}}} = 1-\cfrac{1}{1-\cfrac{1}{\cfrac{1-a-1}{1-a}}}$$

$$= 1-\cfrac{1}{1-\cfrac{1}{\cfrac{-a}{1-a}}}$$

$$= 1-\cfrac{1}{1-\cfrac{1-a}{-a}}$$

$$= 1-\cfrac{1}{\cfrac{-a-(1-a)}{-a}}$$

$$= 1-\cfrac{1}{\cfrac{-1}{-a}}$$

$$= 1-1\times\frac{a}{1}$$

$$= 1-a$$

2. ***Ans. D.*** *28.*

$$[(5 + 8 \times 9 \div 12 - 3^2) \times (56 \div 14 \times 13 - 261 \div 87)^{\frac{1}{2}}] \div 0.5$$

$$= [(5 + 72 \div 12 - 9) \times (4 \times 13 - 3)^{\frac{1}{2}}] \div 0.5$$

$$= [(5 + 6 - 9) \times \sqrt{52 - 3}\,] \div 0.5$$

$$= (2 \times \sqrt{49}) \div 0.5$$

$$= 2 \times 7 \div 0.5$$

$$= 28$$

3. ***Ans. A.*** *3.*

Simplify by changing the exponential form to radical form like the following

$$\sqrt{\frac{\left(81^{\frac{1}{2}}\right)\left(27^{\frac{1}{2}}\right)}{3\sqrt{3}}} = \sqrt{\frac{\sqrt{81}\cdot\sqrt{27}}{3\sqrt{3}}}$$

$$= \sqrt{\frac{(9)\left(3\sqrt{3}\right)}{3\sqrt{3}}}$$

$$= \sqrt{9} = 3$$

4. ***Ans. A.*** *−26.*

$$\begin{aligned}(3i-2)(6i+4) &= 18i^2 + 12i - 12i - 8\\ &= 18(-1) - 8\\ &= -18 - 8\\ &= -26\end{aligned}$$

5. ***Ans. B.*** *128.*

$$\frac{2^{n+1}\cdot 128}{2^{n-1}\cdot 4} = \frac{2^n \cdot 2 \cdot 2^7}{2^n \cdot 2^{-1} \cdot 2^2}$$

$$= \frac{2^8}{2} = 2^7$$

$$= 128$$

6. ***Ans. C.*** $-\frac{3}{5} - \frac{1}{5}i$.

$$\frac{1-2i+3i^2}{1+2i-3i^2} = \frac{1-2i+3(-1)}{1+2i-3(-1)} = \frac{1-2i-3}{1+2i+3}$$

$$= \frac{-2-2i}{4+2i} = \frac{\cancel{2}(-1-i)}{\cancel{2}(2+i)}$$

Rationalize the denominator,

$$\frac{-1-i}{2+i}\cdot\frac{2-i}{2-i}=\frac{-2+i-2i+i^2}{4-i^2}$$

$$=\frac{-2-i-1}{4-(-1)}$$

$$=\frac{-3-i}{5}$$

$$=-\frac{3}{5}-\frac{1}{5}i$$

7. *Ans. C.* x^{17}

$$\frac{x^3\left(x^{-2}\right)^4\left(x^2\right)^{-3}}{\left(x^{-1}\right)^2\left(x^5\right)^{-1}\left(x^7\right)^{-3}}=\frac{\left(x^3\right)\left(x^{-8}\right)\left(x^{-6}\right)}{\left(x^{-2}\right)\left(x^{-5}\right)\left(x^{-21}\right)}$$

$$=\frac{x^{3-8-6}}{x^{-2-5-21}}$$

$$=\frac{x^{-11}}{x^{-28}}$$

$$=x^{-11-(-28)}=x^{17}$$

8. ***Ans. B.*** *198.*

In an infinitely decreasing geometric sequence:

$$S_\infty = \frac{a}{1-r} \Rightarrow a = 66 \text{ (first term)}; \; r = \tfrac{2}{3} \text{ (common ratio)}$$

$$\therefore \; S_\infty = \frac{66}{1-\frac{2}{3}}$$

$$= \frac{66}{\frac{1}{3}}$$

$$= 66 \times 3 = 198$$

9. ***Ans. C.*** *{ 2, 3 }.*

Since this is a quadratic equation, transpose all terms to one side.

$$x^2 + 10x - 5 - 15x + 11 = 0$$
$$x^2 - 5x + 6 = 0$$

Factor the quadratic trinomial.

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

Equate each factor to 0, then solve for x.

$$x - 2 = 0 \qquad\qquad x - 3 = 0$$
$$x = 2 \qquad\qquad x = 3$$

10. ***Ans. A.*** $\dfrac{x-y}{xy}$

Substitute the value of x and y to all the choices and see which one will have the greatest value.

A. $$\frac{x-y}{xy}=\frac{-1-2}{(-1)(2)}$$
$$=\frac{-3}{-2}$$
$$=\frac{3}{2}$$

B. $$\frac{x+y}{y-2x}=\frac{(-1)+2}{2-2(-1)}$$
$$=\frac{1}{2+2}$$
$$=\frac{1}{4}$$

C. $$\frac{x^{-1}+y^{-2}}{y^{-1}}=\frac{(-1)^{-1}+(2)^{-2}}{(2)^{-1}}=\frac{-\frac{1}{1}+\frac{1}{2^2}}{\frac{1}{2}}$$
$$=\frac{-1+\frac{1}{4}}{\frac{1}{2}}=2\left(-1+\frac{1}{4}\right)=-\frac{3}{2}$$

D. $\dfrac{2x-y^{-1}}{x^{-2}} = \dfrac{2(-1)-(2)^{-1}}{(-1)^{-2}}$

$$= \frac{-2-\frac{1}{2}}{\frac{1}{(-1)^2}}$$

$$= \frac{-\frac{5}{2}}{1}$$

$$= -\frac{5}{2}$$

11. ***Ans. D.*** $y = \dfrac{5}{x-1}$.

Given equation:

$$y = \frac{x+5}{x}$$

To solve for the inverse function, interchange x and y.

$$x = \frac{y+5}{y}$$

Solve for y.

$$x = \frac{y+5}{y}$$

$$xy = y + 5$$

$$xy - y = 5$$

$$y(x-1) = 5$$

$$y = \frac{5}{x-1}$$

12. ***Ans. D.*** $\dfrac{9+3x}{1-x^2}$.

$$\frac{3}{1-x} - \frac{3}{x-1} + \frac{3}{x+1} = -\frac{3}{x-1} - \frac{3}{x-1} + \frac{3}{x+1}$$

$$= -\frac{6}{x-1} + \frac{3}{x+1}$$

$$= \frac{-6(x+1)}{(x-1)(x+1)} + \frac{3(x-1)}{(x-1)(x+1)}$$

$$= \frac{-6x - 6 + 3x - 3}{x^2 - 1}$$

$$= \frac{-3x - 9}{x^2 - 1}$$

$$= \frac{-(9+3x)}{-(1-x^2)}$$

$$= \frac{9+3x}{1-x^2}$$

13. ***Ans. D.*** $\frac{15}{8}$.

Using Pythagorean Theorem,

$$\left(\frac{x}{2}\right)^2 + (x-1)^2 = (x+1)^2$$

$$\frac{x^2}{4} + x^2 - 2x + 1 = x^2 + 2x + 1$$

$$x^2 + 4x^2 - 8x + 4 = 4x^2 + 8x + 4$$

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

$$x^2 - 16x = 0$$

$$x(x-16) = 0$$

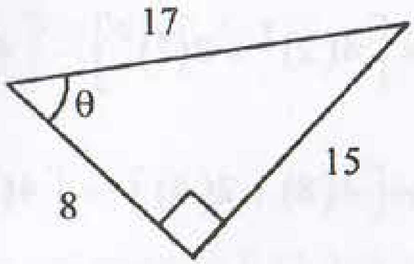
Equate both factors to 0 and solve for x.

$$x = 0 \qquad\qquad x - 16 = 0$$
$$x = 16$$

Since length cannot be equal to 0, the value of $x = 16$. Hence,

$$\frac{x}{2} = 8 \qquad x - 1 = 15 \qquad x + 1 = 17$$

Therefore,



$$\tan\theta = \frac{\text{opposite side of }\theta}{\text{adjacent side of }\theta}$$

$$= \frac{15}{8}$$

14. ***Ans. D. 4.***

$$\left(16^{a+1}\right)\left(4^{a}\right)\left(2^{a-1}\right) = \left(2^{2a+1}\right)\left(16^{a}\right)\left(4^{a-1}\right)$$

$$\left(2^{4}\right)^{a+1}\left(2^{2}\right)^{a}(2)^{a-1} = (2)^{2a+1}\left(2^{4}\right)^{a}\left(2^{2}\right)^{a-1}$$

$$(2)^{4a+4}(2)^{2a}(2)^{a-1} = (2)^{2a+1}(2)^{4a}(2)^{2a-2}$$

$$2^{7a+3} = 2^{8a-1}$$

Since the bases are the same, then

$$7a + 3 = 8a - 1$$

$$-a = -4$$

$$a = 4$$

15. ***Ans. C. 34.***

$$f(2)-f(1)=\left[4(2)^3+2(2)^2\right]-\left[4(1)^3+2(1)^2\right]$$

$$=\left[4(8)+2(4)\right]-\left[4(1)+2(1)\right]$$

$$=(32+8)-(4+2)$$

$$=40-6$$

$$=34$$

Section 2. Word Problems.

16. ***Ans. C. ₱ 12,900.00.***

Given: rate = 7.5% = 0.075

original price = ₱ 12,000.00

mark-up = rate × original price

= (0.075)(₱ 12,000.00)

= ₱ 900.00

selling price = original price + mark-up

= ₱ 12,000.00 + ₱ 900.00

= ₱ 12,900.00

17. ***Ans. D. ₱ 825,000.00.***

selling price = original price + mark-up

therefore: original price (OP)= selling price − mark-up

but: mark-up = rate × OP

∴ original price = selling price − (rate)(OP)

Given: selling price = ₱ 899,250.00

rate = 9% = 0.09

Let x = original price

x = ₱ 899,250.00 − $0.09x$

$x + 0.09x$ = ₱ 899,250.00

$1.09x$ = ₱ 899,250.00

x = ₱ 825,000.00

18. ***Ans. D.*** *₱ 500.00.*

Total cost of shipment = (400)(₱ 375.00)

= ₱ 150,000.00

Desired overall profit = 20% of ₱ 150,000.00

= ₱ 30,000.00

Total amount = ₱ 150,000.00 + ₱ 30,000.00

= ₱ 180,000.00

Number of CD's estimated to become sale items:

= 20% of 400

= 80

Number of CD's estimated to be sold at regular price:

= 400 − 80

= 320

Let x = regular selling price

Therefore:

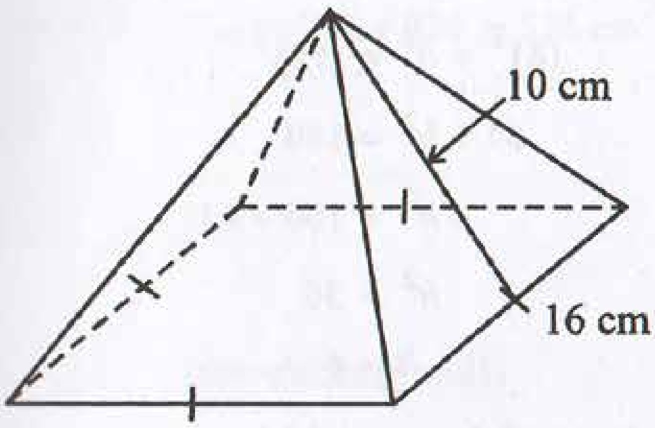
$$320x + 80(50\%)x = ₱\ 180{,}000.00$$

$$320x + 40x = ₱\ 180{,}000.00$$

$$360x = ₱\ 180{,}000.00$$

$$x = ₱\ 500.00$$

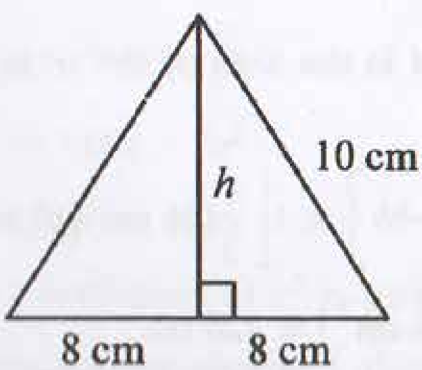
For items 19-20:



The volume of a pyramid is $V = \frac{1}{3}Bh$, where B is the area of the base (in this case the square base) and h is the lateral height from the base to the top of the pyramid (in this case, h is not the height of the triangular faces).

19. *Ans. A. 512 cm^3.*

First, solve for the height of the pyramid. The following figure is a cross-section of the pyramid (which is a triangle).



By Pythagorean Theorem,

$$(8)^2 + h^2 = (10)^2$$
$$64 + h^2 = 100$$
$$h^2 = 100 - 64$$
$$h^2 = 36$$
$$h = 6$$

Hence, the volume of the pyramid is

$$V = \frac{1}{3}Bh = \frac{1}{3}(16\text{ cm})^2(6\text{ cm})$$
$$= \frac{1}{3}(256)(6) = 512\text{ cm}^3$$

20. ***Ans. B.*** *576 cm²*.

The surface area of a pyramid is given by $SA = B + TLA$, where B is the area of the base and TLA is the Total Lateral Area. Since B was computed in the previous question, we only need to compute for TLA.

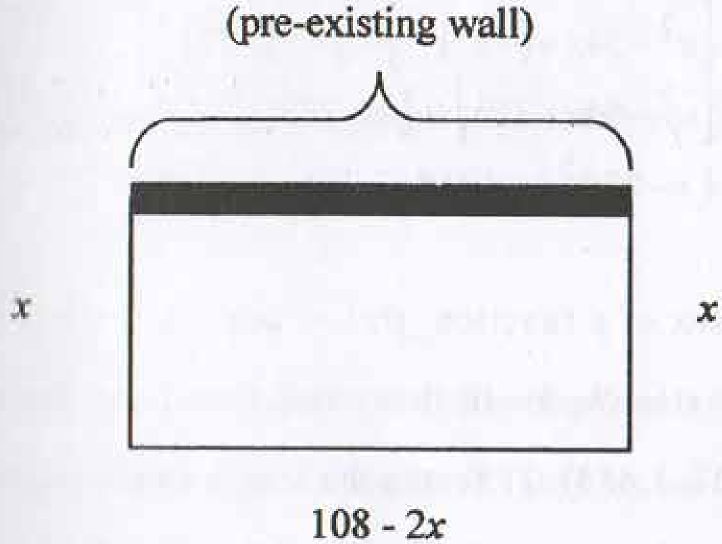
$TLA = 4A$, where A is the area of the triangular face

$$TLA = 4\left[\frac{1}{2}bh\right] = 4\left[\frac{1}{2}(16\text{ cm})(10\text{ cm})\right]$$
$$= 4\left(80\text{ cm}^2\right) = 320\text{ cm}^2$$

Therefore,

$$SA = B + TLA = 256 + 320 = 576 \text{ cm}^2$$

21. ***Ans. C. 1,458 sq. feet.***



Let x = **length of one of the widths**

$108 - 2x$ = **length of the third side to be fenced**

$Area$ = **width times length**

$$A = x\,(108 - 2x)$$

$$A = 108x - 2x^2$$

In a quadratic function such as this one, the maximum value (minimum if the coefficient of x^2 is positive) is given by the vertex. The vertex can be obtained either by completing the

square or using the vertex formula.

Using the method of completing the square, we get

$$
\begin{aligned}
A &= -2\,(x^2 - 54x) \\
&= -2\left[x^2 - 54x + \left(\frac{-54}{2}\right)^2\right] - \left[-2\left(\frac{-54}{2}\right)^2\right] \\
&= -2\left[x^2 - 54x + (-27)^2\right] - \left[-2\,(-27)^2\right] \\
&= -2\left[x^2 - 54x + 729\right] - \left[-2\,(729)\right] \\
&= -2\,(x-27)^2 + 1{,}458
\end{aligned}
$$

The vertex of a function $f(x) = a(x - h)^2 + k$ is given by the coordinates (h, k). In this case, therefore, the vertex is given by (27, 1,458). 27 feet is the length of the width (x) that gives the maximum area ($f(x)$ or, in this case, A), which 1,458 sq. feet.

The alternative way to obtain this answer is to get the k-value of the vertex using the vertex formula, which is

$$\left(\frac{-b}{2a}, \frac{4ac-b^2}{4a}\right)$$

given a function of the form $f(x) = ax^2 + bx + c$. In the case of

$$A = 108x - 2x^2$$

$a = -2$, $b = 108$, and $c = 0$. The k-value $\left(\dfrac{4ac-b^2}{4a}\right)$

gives the maximum area. Substituting, we get

$$\begin{aligned} k &= \frac{4ac-b^2}{4a} \\ &= \frac{4(-2)(0)-108^2}{4(-2)} \\ &= \frac{-11664}{-8} \\ &= 1{,}458 \text{ sq. feet} \end{aligned}$$

and thus the maximum area possible is 1,458 sq. feet.

22. *Ans. B. 6.*

Each hero needs to cover the following area:

2,500 + 1,250 + 3,300 + 4,100 =11,150 sq. meters

There is a total area of 6.69×10^{-2} sq. *kilometers* to be covered by the entire team, or in meters,

$$\begin{aligned} & 6.69 \times 10^{-2} \text{ sq.km} \times \left(\frac{1{,}000 \text{ m}}{1\text{km}}\right)^2 \\ &= 6.69 \times 10^{-2} \text{ sq.km} \times \frac{1{,}000{,}000 \text{ sq.m}}{1 \text{ sq.km}} \\ &= 66{,}900 \text{ sq. meters} \end{aligned}$$

Thus,

$$\frac{66{,}900 \text{ sq. meters}}{11{,}150 \text{ sq.m per team member}} = 6 \text{ team members}$$

23. ***Ans. B.*** $3\frac{1}{3}$ *seconds*.

Recall that work = rate × time.

Let t = number of hours the two will finish doing the work together

$\frac{1}{10}$ = rate of Ingrid

$\frac{1}{5}$ = rate of Julienne

Thus, from $W = (r)(t)$, where $W = 1$

$$\left(\frac{1}{10}+\frac{1}{5}\right)t = 1$$

$$\frac{3}{10}t = 1$$

$$t = \frac{10}{3}$$

$$= 3\frac{1}{3} \text{ seconds}$$

24. ***Ans. C.*** *it will be multiplied by 16.*

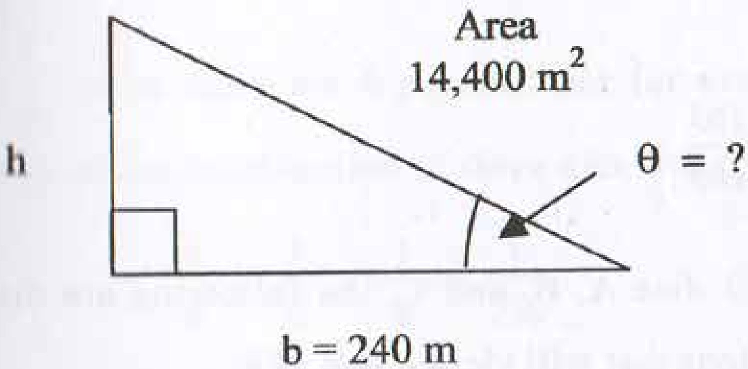
ρ - density m - mass v - volume

k - constant of proportionality

$$\rho = \frac{km}{v}$$

$$\rho' = \frac{k(4m)}{\frac{1}{4}v} = \frac{4km}{\frac{1}{4}v} = \frac{16km}{v} = 16\rho$$

15. ***Ans. B.*** *(tan^{-1} $\frac{1}{2}$)^{o}.*



The area of the lot is given by half the product of the base and the height; in this case, the base and the height are the legs of the right triangle. The length of the unknown leg can be solved using the given area and the known leg.

$$A_{\Delta} = \frac{1}{2}(bh)$$

$$14{,}400 \text{ m}^2 = \frac{(240 \text{ m}) \times h}{2}$$

$$28{,}800 \text{ m}^2 = (240 \text{ m}) \times h$$

$$h = 120 \text{ m}$$

Thus, the two legs have measures of 240 m and 120 m. The angle made by the hypotenuse and the 240 m leg can be expressed by the inverse tangent function, which depends on the side opposite the angle (in this case, 120 m) and the side adjacent to it (240 m).

$$\tan\theta = \frac{120}{240} = \frac{1}{2}$$

$$\theta = \tan^{-1}\frac{1}{2}$$

26. ***Ans. B.*** $\frac{103}{108}$.

Given 3 dice A, B, and C, the following are the possible combinations that will yield a sum of 6:

	A	B	C
Resulting	1	1	4
numbers	1	2	3
	1	3	2
	1	4	1
	2	1	3
	2	2	2
	2	3	1
	3	1	2
	3	2	1
	4	1	1

Note that a die cannot have a resulting number of 5 or 6. The other two dice will *each* have a minimum resulting number of 1, and adding them together gives 2, which when added to 5 or 6 of a third die will yield a sum of either a 7 or 8, respectively. Combinations including 5 or 6 will yield sums greater than 6.

We can see that there are 10 possible combinations of resulting numbers which can give a sum of 6. The probability of *each* combination can be calculated thus:

The probability of one number resulting for *each* die is 1 out of 6 or $\frac{1}{6}$, since there are 6 possibilities for each die. The probability of any combination of *three* dice will thus be

$$\frac{1}{6} \times \frac{1}{6} \times \frac{1}{6} = \frac{1}{216}$$

Since there are 10 possible combinations which can give a sum of 6, with each combination having a probability of $\frac{1}{216}$, the probability of having a combination which gives a sum of 6 is

$$10 \times \frac{1}{216} = \frac{10}{216} = \frac{5}{108}$$

This, however, is the probability of a combination of dice whose sum *is* 6. The probability, then, that the combination of the three dice will *not* yield a sum of 6 is given by

$$1 - \frac{5}{108} = \frac{103}{108}$$

27. ***Ans. D. 216 and 343.***

Recall that the factors of a sum of two cubes are given by

$$x^3 + y^3 = (x + y)(x^2 - xy + y^2)$$

Therefore, we can say that

$$x + y = \left(\sqrt[3]{x} + \sqrt[3]{y}\right)\left(\sqrt[3]{x^2} - \sqrt[3]{xy} + \sqrt[3]{y^2}\right)$$

From the given

$$\sqrt[3]{x} + \sqrt[3]{y} = 13$$

and

$$\sqrt[3]{x^2} - \sqrt[3]{xy} + \sqrt[3]{y^2} = 43$$

we can substitute into the above equations and see that

$$x + y = (13)(43)$$
$$x + y = 559$$

Taking this resulting equation and the other given equation, that is, $x - y = -127$, we will have a system of equations in two variables.

$$\begin{cases} x + y = 559 \\ x - y = -127 \end{cases}$$

There are a number of ways to solve a system of equations;

any can be used. In this case, we will do elimination by adding the two equations together to eliminate the variable y. Thus,

$$x + x + y - y = 559 - 127$$
$$2x = 432$$
$$x = 216$$

and, substituting this calculated x value into either of the original equations, we can see that

$$y = 343$$

18. *Ans. B.* $\begin{cases} 12 = \dfrac{1}{x} - \dfrac{1}{y} \\ 16 = \dfrac{1}{x} + \dfrac{1}{y} \end{cases}$

When going upstream, a boat will run *against* the current, and hence the net rate will be the speed of the boat in still water $\left(\frac{1}{x}\right)$ minus the speed of the current $\left(\frac{1}{y}\right)$, that is,

$$\frac{1}{x} - \frac{1}{y} = \text{net rate upstream}$$

When going downstream, a boat will run *with* the current, and hence the net rate will be the speed of the boat in still water plus the speed of the current, that is,

$$\frac{1}{x} + \frac{1}{y} = \text{net rate downstream}$$

Distance is given by the formula: rate (speed) × time. Thus, if the boat can cover 24 km in 2 hours going upstream, the correct equation for this will be

$$24 = \left(\frac{1}{x} - \frac{1}{y}\right)(2)$$

If the boat can cover the same distance going back in 1.5 hours, then it will be going downstream already, and the correct equation for this will be

$$24 = \left(\frac{1}{x} + \frac{1}{y}\right)(1.5)$$

Taking these two equations together can solve for the speed of the boat in still water, as well as that of the current. The resulting system of equations will thus be

$$\begin{cases} 24 = \left(\frac{1}{x} - \frac{1}{y}\right)(2) \\ 24 = \left(\frac{1}{x} + \frac{1}{y}\right)(1.5) \end{cases}$$

which, when simplified, will give

$$\begin{cases} 12 = \frac{1}{x} - \frac{1}{y} \\ 16 = \frac{1}{x} + \frac{1}{y} \end{cases}$$

For nos. 29 to 31. Re: Knightman, his gadgets, and his utility belt.

29. *Ans. B. 35.*

With 7 gadgets/equipment left, Knightman can choose any three to finally put into the belt. The answer is simply the possible combinations resulting from 7 gadgets taken 3 at a time. Thus

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

$$_7C_3 = \frac{7!}{3!(7-3)!}$$

$$= \frac{7!}{3!4!}$$

$$= \frac{7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{(3 \times 2 \times 1)(4 \times 3 \times 2 \times 1)}$$

$$= \frac{7 \times 6 \times 5}{3 \times 2 \times 1}$$

$$= 7 \times 5$$

$$= 35$$

30. *Ans. C. 210.*

With 7 gadgets left, Knightman can choose any three to put into the belt. From the possible combinations, he can arrange the gadgets in many different ways. The answer is the possible permutations resulting from 7 gadgets taken 3 at a time.

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

$$_{7}P_{3} = \frac{7!}{(7-3)!}$$

$$= \frac{7!}{4!}$$

$$= \frac{7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{4 \times 3 \times 2 \times 1}$$

$$= 7 \times 6 \times 5$$

$$= 210$$

31. ***Ans. A. 6.***

When Knightman finally chooses which 3 gadgets to pack, he can arrange these 3 gadgets in different ways. The answer is simply the possible permutations of these 3 gadgets taken 3 at a time, or simply the possible permutations of these 3 gadgets.

$$_3P_3 = \frac{3!}{(3-3)!}$$

$$= \frac{3!}{0!}$$

$$= \frac{3 \times 2 \times 1}{1}$$

$$= 6$$

12. *Ans. B. sin x.*

A close inspection of the curve will show that it is the graph for the sine function, that is $y = \sin x$.

13. *Ans. C. 18,480.*

The number of distinct permutations depends on the fact that some statues are identical. The number of distinct permutations P of n things taken all at a time, and where there are p of one kind, q of another kind, r of another, and so on, is

$$P = \frac{n!}{p!q!r!\ldots}$$

In this question, there are all in all 12 statues: 6 of one kind (Hera) and 3 each of two other kinds (Demeter and Hestia).

$$P = \frac{12!}{6!3!3!}$$

$$= \frac{12 \times 11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{(6 \times 5 \times 4 \times 3 \times 2 \times 1)(3 \times 2 \times 1)(3 \times 2 \times 1)}$$

$$= \frac{12 \times 11 \times 10 \times 9 \times 8 \times 7}{3 \times 3 \times 2 \times 2}$$

$$= 3 \times 11 \times 10 \times 8 \times 7 \quad = 18{,}480$$

34. *Ans. D. 28.*

Let x - the number of years back when Cora was two and half times as old as Erlinda

$$63 - x = \frac{5}{2}(42 - x)$$

$$2(63 - x) = 5(42 - x)$$

$$126 - 2x = 210 - 5x$$

$$5x - 2x = 210 - 126$$

$$3x = 84$$

$$x = 28$$

35. ***Ans. A.*** $12-4\sqrt{3}$.

Observe that the larger triangle is a 30°-60°-90° triangle which means that the side opposite the 60° angle has a measurement equal to $4\sqrt{3}\left(\sqrt{3}\right)=12$.

Note that the smaller triangle is an isosceles right triangle so its other leg has a measure of $4\sqrt{3}$.

Thus,

$$x+4\sqrt{3}=12$$
$$x=12-4\sqrt{3}$$

Section 3. Data Interpretation.

A. **Pop Band Survey**

36. ***Ans. B.*** *Boyzone and All Saints.*

In 1998, Boyzone had 20.0% of all votes cast that year, which was 4,000 votes. Hence, they had 20.0% of 4,000, or 800 votes, in 1998. The following year, they only had 16.0% of all votes cast that year; however, the sample size had increased to 5,000. Thus, in 1999, they had 16.0% of 5,000, or 800 votes, which is the same as the previous year.

Meanwhile, in 1999, All Saints had 3.0% of all votes cast that year, which was 5,000. Hence, they had 3.0% of 5,000, or 150 votes, in 1999. The following year, they had 2.5% of all votes cast, but the sample size had increased to 6,000. Hence, they had 2.5% votes of 6,000, or 150 votes, which is also the same as the previous year.

37. ***Ans. B.*** *Backstreet Boys.*

As seen in the chart, the Backstreet Boys had a percent decrease in fans between 1999 and 2000 - from 50.0%, they dropped to 25.0%, a net decrease of 25.0%. This is the biggest drop for any of the groups in question between 1999 and 2000.

38. ***Ans. A.*** *Westlife.*

As can be easily inferred from the graph, Westlife was not yet included in the 1998 survey. Hence, it is this band (from those included in the entire annual survey) that was most possibly not yet in the industry then, or at least had not yet broken through.

39. ***Ans. C.*** *2,050.*

In 2000, Westlife had 42.5% of all the 6,000 votes cast, or 2,550 fans voting for them. In 1999, they only had 10.0% of the 5,000 votes cast, or 500 fans voting for them. Thus, the difference would be $2{,}550 - 500 = 2{,}050$, that is, 2,050 more people voted for Westlife the following year.

40. ***Ans. D.*** *24.75%.*

In 1998, the Spice Girl fans were 45.0% of the 4,000 people surveyed. That is, 1,800 were Spice Girls fans. Of these, 810 were said to be male. Therefore, the female Spice Girl fans were 1,800 – 810 = 990.

Thus, of everyone surveyed in 1998, 990 were female Spice Girl fans. This is 24.75% of the entire sample (4,000 surveyed).

Alternatively, 810 of the 4,000 surveyed were male Spice Girl fans; that is, 20.25% of all surveyed were male Spice Girl fans. Subtracting 20.25% from 45.0% (the total percent of Spice Girl fans) will also yield 24.75%.

H. Organizational Fundraising

41. ***Ans. A.*** *Socio-Civic.*

Although the Externals committee has raised the highest gross amount of money among all the committees (₱ 6,300.00), the Socio-Civic committee has raised the highest amount of money *relative to its goal* - i.e., ₱ 4,800.00 out of a ₱ 6,000.00 goal, or 80% of its goal. The Externals committee only comes next, since it has raised ₱ 6,300.00 out of an ₱ 8,000.00 goal, or 78.75% of its goal. Thus, the Socio-Civic committee has raised the highest amount of money relative to its goal.

42. ***Ans. C.*** *55.37%.*

The total goal of the entire organization is the sum of each committee's individual goal. This is ₱ 7,000.00 + ₱ 6,000.00 + ₱ 6,000.00 + ₱ 5,000.00 + ₱ 7,000.00 + ₱ 8,000.00 + ₱ 7,000.00 + ₱ 8,000.00 + ₱ 4,000.00 = ₱58,000.00.

The total amount the organization has raised is the sum of each committee's achievement. This is ₱ 4,550.00 + ₱ 2,700.00 + ₱ 4,800.00 + ₱ 950.00 + ₱ 4,900.00 + ₱ 6,300.00 + ₱ 2,555.00 + ₱ 3,600.00 + ₱ 1,760.00 = ₱ 32,115.00.

Thus, the percent of the total goal raised is

$$\frac{32,115.00}{58,000.00} \times 100\% \cong 55.37\%$$

43. ***Ans. D.*** *Biologue, Sports, and Secretariat.*

Careful observation of the values will reveal that the Biologue committee has raised ₱ 3,600.00 of its ₱ 8,000.00 goal; thus, the committee needs to raise ₱ 4,400.00 more. The Sports committee has raised ₱ 2,555.00 of its ₱ 7,000.00 goal and must raise ₱ 4,445.00 more. The Secretariat committee has raised ₱ 950.00 of its ₱ 5,000.00 and must thus raise ₱ 4,050.00 more. These are the three committees which must raise the greatest net amount of money in order to meet their goals.

44. ***Ans. A.*** *₱ 7,990.00.*

It can be inferred that the Academics committee must raise ₱ 3,300.00 more (₱ 6,000.00 – ₱ 2,700.00) and the Alumni Relations committee should acquire ₱ 2,240.00 (₱ 4,000.00 – ₱ 1,760.00). Meanwhile, the Membership committee has to raise ₱ 2,450.00 more (₱ 7,000.00 – ₱ 4,550.00).

Thus, the amount that these three committees need to raise is ₱ 3,300.00 + ₱ 2,240.00 + ₱ 2,450.00 = ₱ 7,990.00.

45. ***Ans. D.*** *128.57%.*

The Externals committee has already raised ₱ 6,300.00. The Finance committee has only raised ₱ 4,900.00. The amount of money that the Externals Committee has raised relative to that that the Finance committee has raised is thus solved this way:

$$\text{Externals money} = (\text{percent}) \times (\text{Finance money})$$

$$\text{percent} = \frac{\text{Externals money}}{\text{Finance money}} \times 100\%$$

$$\text{percent} = \frac{6{,}300}{4{,}900} \times 100\%$$

$$= 128.57\%$$

The percentage is greater than 100% because the Externals committee has raised a higher net amount of money than the Finance committee has done.

C. Distribution of Graduates

46. *Ans. B. 46.15%.*

The total number of graduates of the university from 1976-2000 is the sum of all the given data, whether male or female, no matter the course. This, when calculated by simple addition, is 51,615.

The total number of graduates from all the courses, whether male or female, that come from the 1990's (i.e., combined periods 1991-1995 and 1996-2000) is the sum of the data for both time periods. This is $11,535 + 12,285 = 23,820$.

The percentage of all 1990's graduates relative to the entire sample is thus

$$\frac{23,830}{51,615} \times 100\% \cong 46.15\%$$

47. *Ans. A. 17.67%.*

The total number of female Science/Engineering graduates from 1976-1990 is the sum of the female graduates for each of three time periods (1976-1980, 1981-1985, and 1985-1990). This is 3,780.

The total number of female Science/Engineering graduates from 1991-2000 is the sum of the female graduates for two time periods (1991-1995 and 1996-2000). This is 4,448.

The net increase in female graduates in the said bracket of courses is thus $4,448 - 3,780 = 668$. The increase is 668 graduates from an original total of 3,780. The percentage is

$$\frac{668}{3,780} \times 100\% \cong 17.67\%$$

Alternatively, it can be calculated from 4,448 and 3,780 first, as follows:

$$4,448 = 3,780 \times \text{ percent}$$

$$\text{percent} = \frac{4,448}{3,780} \times 100\%$$

$$\cong 117.67\%$$

Then, we subtract 100% from the result (100% being equivalent to 3,780), and we get

$$117.67\% - 100\% = 17.67\%$$

which is the same result.

48. ***Ans. B.*** *38.58%.*

The decade of the 1980's is the combined time periods 1981-1985 and 1986-1990. The total number of graduates of that time is the sum of all the male and female graduates in all the courses. This, when calculated, is 19,455.

The combined number of Business/Economics and Social Science/Politics graduates for that decade (male and female inclusive) is 7,505.

The percent of all the 1980's graduates that are either Business/Economics or Social Science/Politics majors is thus

$$\frac{7{,}505}{19{,}455} \times 100\% \cong 38.58\%$$

49. ***Ans. C.*** *2,701.*

All in all, there are a total of 6,415 female Social Science/ Politics graduates when added. Meanwhile, there are 3,714 male Masscom/Arts/Literature/Languages graduates. Thus, there are 6,415 – 3,714 = 2,701 more female Social Science/Politics graduates than there are male Masscom/Arts/Literature/ Languages graduates.

50. ***Ans. B.*** *185.*

The total combined number of male graduates of Science/ Engineering courses and Business/Economics courses is 7,877 in the 1980's (1981-1990) and 7,692 in the 1990's (1991-2000).

The number, therefore, decreased by 7,877 – 7,692 = 185 between the two decades in question.