

## ANSWERS MATH B – June 22<sup>nd</sup> 2004

- 1) The problem asks for the sum of  $2 - \sqrt{-4}$  and  $-3 + \sqrt{-16}$ .  
The 2 and  $-3$  are easily combined. Their sum is  $-1$ .

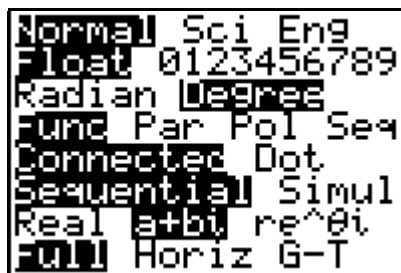
$$\sqrt{-4} = \sqrt{4} @ \sqrt{-1} = 2i \text{ and } -\sqrt{-4} = -2i \text{ In the same manner, } \sqrt{-16} = 4i$$

$$-2i + 4i = 2i$$

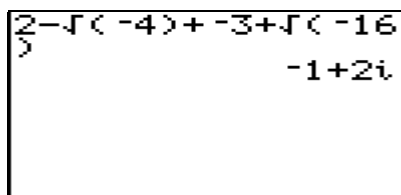
The final answer is **-1+2i**

I have no idea why anyone would want to use their calculator for this problem, but here are the steps that you would use:

**MODE**       **ENTER** This is the mode for imaginary numbers.



The first screen at the left is what your screen will look like after entering the above to change to a+bi mode.



Once you are in a+bi mode you can enter the problem as you see it. First CLEAR your calculator screen by hitting **CLEAR**. Now input the problem and hit enter. Your screen will look like the one at the left. Make sure you do not mix up the subtraction key and the negative key. The negative key is the one in parenthesis at the bottom right of your calculator. Right next to the ENTER key. On your screen it shows up as being slightly raised. **ANSWER: (1)**

- 2) The probability for rain is given as .7. This means that the probability of “no” rain is .3.  
The probability for rain on exactly 3 of the 7 days will be a combination of  ${}^7C_3$  multiplied by  $(.7)^3$  multiplied by  $(.3)^4$ . There are 7 days involved and we want 3 of them to have rain and 4 of them to have no rain.

The final answer will be:  ${}^7C_3 (.7)^3 (.3)^4$  **ANSWER: (1)**

- 3) In an equation of the form of  $y = a \sin bx$  or  $y = a \cos bx$ , the amplitude is represented by  $a$ . Therefore, in the equation that is given:  $y = \frac{2}{3} \sin 4x$ , the amplitude is  $\frac{2}{3}$ .

**ANSWER: (2)**

- 4) You are shown a parabola and asked to identify its function.  
Step #1. You see that it opens upwards so that  $a$  will be positive. That leaves choices 2 & 4. Let's check choice 2 & 4 using the point (2,8).

$$y = 2x^2 \qquad y = \frac{1}{2}x^2$$

$$8 = 2(2)^2 \qquad 8 = \frac{1}{2}(2)^2$$

$$8 = 2(4) = 8 \text{ \%} \qquad 8 = \frac{1}{2}(4) = 2 \text{ wrong} \qquad \text{ANSWER: (2)}$$

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- 5) You are presented with the graph of  $x^2 + y^2 = 1$ , and told that a transformation  $T$  will map every  $(x,y)$  to  $(2x,4y)$ . This means that the x-intercepts which are now at  $\pm 1$  will be multiplied by 2 and become  $\pm 2$ , and the y-intercepts which are now at  $\pm 1$  will be multiplied by 4 and become  $\pm 4$ . **This is depicted by the graph of the ellipse in choice 3.**

**ANSWER: (3)**

- 6) You are asked to find the value of  $f(4)$  when  $f(x) = 4x^0 + (4x)^{-1}$ .

$$4x^0 + (4x)^{-1}$$

$$4(4)^0 + (4 \cdot 4)^{-1} \quad 4 \text{ to the 0 is } 1$$

$$4(1) + (16)^{-1} \quad \text{Anything to a neg. exponent is } 1 \text{ over that anything to the pos. exponent.}$$

$$4 + \frac{1}{16} \text{ which equals } 4\frac{1}{16}.$$

**ANSWER: (4)**

- 7) A fraction is undefined when its denominator is equal to 0. The denominator of the given function is  $x^2 - 9$ . All you have to do now is set  $x^2 - 9$  equal to 0 and solve for  $x$ .

$$x^2 - 9 = 0$$

$$x^2 = 9$$

$$x = \pm 3$$

In other words, **the function will be undefined when  $x$  equals 3 or  $-3$ .**

**ANSWER: (3)**

- 8) In an inverse variation, as one variable increases the other will decrease.

**Choice 1** is the only possible choice. It shows the Stream Velocity decreasing as the distance from the center of the stream is increasing.

**ANSWER: (1)**

- 9) Pick an easy log relationship to remember. Something like  $\log_{10} 100 = 2$  because  $10^2 = 100$ . Now you are presented with:

$$\log_b x = y \text{ using the above you have } b^y = x \text{ or } x = b^y$$

**ANSWER= (4)**

- 10) When multiplying exponents with equal bases, add the exponents.

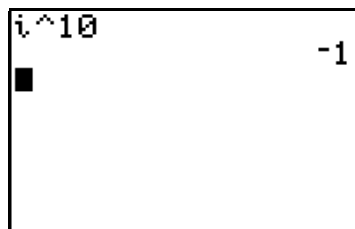
$$\text{Therefore: } i^0 \cdot i^1 \cdot i^2 \cdot i^3 \cdot i^4 = i^{10}$$

$$i^1 = \sqrt{-1} \quad i^2 = -1 \quad i^3 = -i \quad i^4 = 1$$

Now, to simplify a power of  $i$ , simply divide the power by 4 and remember the remainder.

In our case the power is 10. Divided by 4 we get a remainder of 2. That remainder is what we use as our simplified power of  $i$ . In other words,  $i^{10} = i^2 = -1$

Or you can use your calculator to enter the following:



**2nd** **.** **^** **1** **0** **ENTER**

Remember that after hitting the yellow 2<sup>nd</sup> key, you are accessing the symbol to the upper left of the key you are actually hitting. For example, in the above, you are really accessing the **x** and not the **.** (decimal point).

**ANSWER: (2)**

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11) For this problem you can simply try the choices and see that choice 4 is the only one that works. For example let's try all the four choices for (3,40).

Choice 1)  $y=2x+5$   $40=2(3)+5$   $40=6+5$   $40=11$  NOT TRUE.

Choice 2)  $y=2^x$   $40=2^3$   $40=8$  NOT TRUE

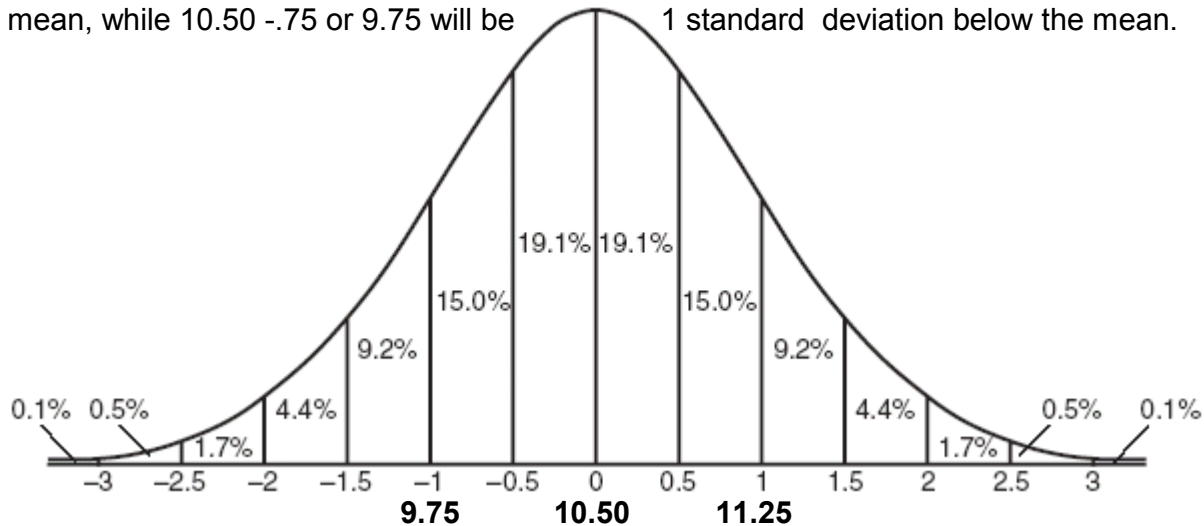
Choice 3)  $y=2x$   $40=2(3)$   $40=6$  NOT TRUE

**Choice 4)  $y=5(2^x)$   $40=5(2^3)$   $40=5(8)$   $40=40$  TRUE**

By the way this is called an exponential curve. It is in the form of  $y=ab^x$ .

**ANSWER: (4)**

12) Based on the bell curve included on the formula page in your regents booklet, and reproduced below, you can see that 68.25% of the data falls within 1 standard deviation of the mean. For this problem you are told that 10.50 is the mean, and .75 is the standard deviation. This means that  $10.50 + .75$  or 11.25 will be 1 standard deviation above the mean, while  $10.50 - .75$  or 9.75 will be 1 standard deviation below the mean.



**ANSWER: (3)**

13) I doubt that the regents wants you to use your calculator for this one, but here is how you can. First determine which angle has a sine of  $5/13$ . This is easily done by accessing the  $\sin^{-1}$  on your calculator, followed by  $5 \div 13$ , followed by **ENTER**. Now multiply your answer by 2 and that will be your **22** Next all you have to do is find the sine of your answer and convert it to a decimal. Here are the steps showing what keys to hit on your calculator and what your screen will look like.

**2nd** **SIN** **5** **÷** **1** **3** **ENTER** **X** **2** **ENTER**

```

sin-1(5/13
22.61986495
Ans*2
45.2397299

```

To the left is what your calculator screen will look like after the above instructions. What remains now is to find the sin of 45.2397299 and convert it to a fraction. Continue with the following keys: **SIN** **2nd** **(-)** **ENTER** This gets you the value of  $\sin 22$  which is .7100591716. Now lets change this decimal to a fraction. Continue with the following:

```

22.61986495
Ans*2
45.2397299
sin(Ans
.7100591716
Ans→Frac
120/169

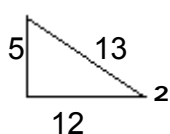
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**MATH** **ENTER** **ENTER**

The fraction will now be converted to **120/169** which is **choice 4**.

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Now for a brief explanation of how to do this problem without a calculator. You are told that  $\sin 2 = 5/13$ . Since the sin ratio is equal to the opposite over the hypotenuse, this means that the triangle in question is a 5-12-13 triangle pictured below to the left.



Using the formula page you see that  $\sin 2A = 2 \sin A \cos A$ . In our case it is :  $\sin 22 = 2 \sin 2 \cos 2$ . You are told that  $\sin 2 = 5/13$ . You see that  $\cos 2 = 12/13$ . All that remains now is some substitution.

$$\sin 22 = 2 \sin 2 \cos 2$$

$$\sin 22 = 2 \left(\frac{5}{13}\right) \left(\frac{12}{13}\right) = 2 \left(\frac{60}{169}\right) = \frac{120}{169}$$

**ANSWER: (4)**

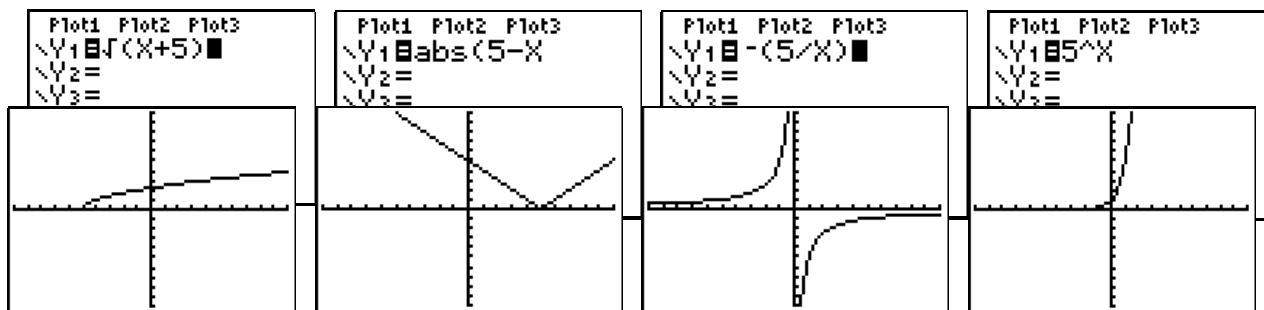
14) Again, using the calculator makes this problem quite easy. The equations are already solved in terms of x so it is a simple matter of inputting them into your calculator:

Equation 1: **Y=** **2nd** **x<sup>2</sup>** **X,T,2n** **+** **5** **)** **zoom** **6**

Equation 2: **Y=** **MATH** **▶** **ENTER** **5** **-** **X,T,2n** **)** **zoom** **6**

Equation 3: **Y=** **(-)** **(** **5** **÷** **X,T,2n** **)** **zoom** **6**

Equation 4: **Y=** **5** **^** **X,T,2n** **zoom** **6**



1)  $y = \sqrt{x+5}$

2)  $y = |5-x|$

3)  $y = -\frac{5}{x}$

4)  $y = 5^x$

**Equation 3 is symmetrical with respect to the origin.**

I will explain briefly how to do this problem without using the calculator. When something is symmetrical with respect to the origin then one of two things can be true. Either it will be symmetrical to the line  $y=x$ , or to the line  $y=-x$ . The first case means that the x and y are interchangeable and the equation will remain true. In the second case where  $y=-x$ , then y and  $-x$  are interchangeable and the equation will remain true. Let's try one wrong answer here and then the right one. Pick numbers that make the equation easy to solve.

Assume that  $x=2$ , then in equation 4, y will equal  $5^2$  or 25. So we have the point (2,25).

Let's switch them to (25,2). Will  $5^{25}=2$ ? Certainly not! Now let's try equation 3.

Assume that  $x=5$  then y will equal  $-5/5$  or  $-1$ . So we have the point (5,-1)

Let's switch them to (-1,5). If  $x=-1$  what will  $y=?$   $-5/-1$  or 5. Switching the coordinates still results in a true equation; therefore equation 3 is symmetrical with respect to the origin.

**ANSWER: (3)**

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15) You are asked for the equivalent of the following expression:

$$\frac{\frac{1}{x} + \frac{1}{y}}{\frac{1}{x^2} - \frac{1}{y^2}}$$

First simplify the numerator. You have :

$\frac{1}{x} + \frac{1}{y}$  Common denominator is  $xy$ . Multiply the first term by  $\frac{y}{y}$  and the second by  $\frac{x}{x}$ .

$\frac{y}{xy} + \frac{x}{xy} = \frac{x+y}{xy}$  This will be the numerator of the complex fraction.

Now let's simplify the denominator of the original complex fraction:

$\frac{1}{x^2} - \frac{1}{y^2}$  Common denominator is  $x^2y^2$ . Multiply first term by  $\frac{y^2}{y^2}$  and the second by  $\frac{x^2}{x^2}$

$\frac{y^2}{x^2y^2} - \frac{x^2}{x^2y^2} = \frac{y^2-x^2}{x^2y^2}$  This is the denominator of your complex fraction.

$$\frac{\frac{x+y}{xy}}{\frac{y^2-x^2}{x^2y^2}} = \frac{x+y}{xy} \div \frac{y^2-x^2}{x^2y^2} = \frac{x+y}{xy} \cdot \frac{x^2y^2}{y^2-x^2} = \frac{x+y}{xy} \cdot \frac{x^2y^2}{(y+x)(y-x)} = \frac{xy}{y-x}$$

**ANSWER: (1)**

16) For all problems of this type, use the Law of Sines:  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

In this problem you are given 2 sides of a triangle and an angle opposite one of the sides.

Set up your ratio:  $\frac{40}{\sin 120} = \frac{15}{\sin B}$  Cross multiply

$40(\sin B) = 15 \sin 120$  Divide by 40

$\sin B = \frac{15 \sin 120}{40}$  Use your calculator to multiply  $\sin 120$  by 15, and divide by 40.

$\sin B = .3247595264$  Now use your  $\sin^{-1}$  key to find angle B.

$\rho B \approx 19^\circ$

```
sin(120)*15/40
.3247595264
sin-1(Ans)
18.95100661
■
```

```
sin(19)
.3255681545
sin(161)
.3255681545
■
```

Now you have 2 angles. You started with an angle of 120 and you calculated an angle of 19, which is the angle opposite the side of 15. Now,  $120+19=139$ , and  $180-139$  will give you the 3<sup>rd</sup> angle. So you now have angles of 120, 19, and 41. Now let's see if another triangle exists.

When you originally arrived at an angle of 19, you should have realized that there is a 19 degree angle in the second quadrant,  $180-19$  or 161 will get you the same sine as an angle of 19. But here is the catch. You already have an angle of 120 so you can not have an angle of 161. Those 2 angles already add up to more than 180 degrees! This means that there is only one possible triangle. The one you originally came up with, with angles of 120, 19, and 41.

**ANSWER: (1)**

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- 17) You are presented with two functions and asked to solve for  $x$  so that  $(g \circ f)(x)$  will equal 0.  $(g \circ f)(x)$  is read as  $g$  of  $f$  of  $x$ . The one function that combines both of these functions is called a composition of functions. Here is one way to do this problem. You are told that  $f(x) = x+1$ . So now, in order to find  $g$  of that, you have to find  $g(x+1)$ . You are told that  $g(x) = x^2 - 1$ . In order to find  $g(x+1)$  you have to substitute  $x+1$  for each occurrence of  $x$  in the original  $g(x)$ . So this is what you would get:

Instead of  $x^2 - 1$  you would have  $(x+1)^2 - 1$  because the  $x+1$  took the place of  $x$ .

Let's continue:  $(g \circ f)(x) = (x+1)^2 - 1$  Square the  $x+1$ .

$(g \circ f)(x) = x^2 + 2x + 1 - 1$  Combine like terms.

$(g \circ f)(x) = x^2 + 2x$

Now this will equal to 0 when:  $x^2 + 2x = 0$  Factor

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

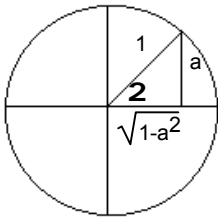
$$x=0 \quad | \quad x+2=0$$

$$| \quad x = -2$$

$(g \circ f)(x)$  will = 0 when  $x=0$  and  $-2$

**ANSWER: (4)**

- 18)



The diagram to the left depicts a positive angle **2** whose sine is  $a$ . The base of the triangle can be found by using the Pythagorean Theorem.

Let  $x$  be that unknown side.

$$x^2 + a^2 = 1^2$$

$$x^2 + a^2 = 1$$

$$x^2 = 1 - a^2$$

$$x = \sqrt{1-a^2} \text{ This is the 3<sup>rd</sup> side of the triangle.}$$

$\cos 2$  is therefore adjacent over hypotenuse or simply  $\sqrt{1-a^2}$ .

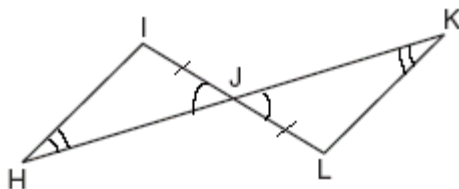
**ANSWER: (2)**

- 19) You are asked to simplify the following expression:  $\sqrt[4]{16a^6b^4}$   
Take the fourth root of each factor in the expression.

$$\sqrt[4]{16} = 2 \quad \sqrt[4]{a^6} = a^{6/4} = a^{3/2} \quad \sqrt[4]{b^4} = b \quad \text{Final answer: } 2a^{3/2}b$$

**ANSWER: (2)**

- 20)



$\angle IJH \cong \angle LJK$  Vertical angles. That's  $A \cong A$ .

You are given that  $HJ \cong KJ$ . That's  $A \cong A$ .

You are given that  $HK$  bisects  $IL$ . That results in  $IJ$  being congruent to  $LJ$ . That's  $S \cong S$ .

Final answer  **$\triangle HIL \cong \triangle KJL$**

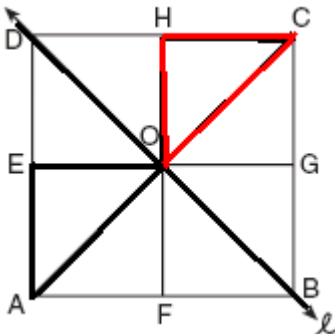
**ANSWER: (3)**

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- 21)  $\sum_{n=0}^2 (13,567n + 294)$  This is a simple problem requiring you to know what the summation symbol means. You are being asked to calculate the sum of what you see in the parenthesis as  $n$  increases from 0 to 2.  
 $(13,567(0)+294) + (13,567(1)+294) + (13,567(2)+294)$   
 $(0+294) + (13,567+294) + (27134+294)$   
 $294 + 13861 + 27428$   
**41583** **ANSWER: 41583**

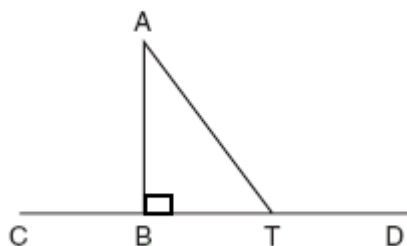
- 22)  $27^{2x+1} = 9^{4x}$  To solve this algebraically you first have to set both expressions to the same base. 27 is  $3^3$  and 9 is  $3^2$ . So you now have  $(3^3)^{2x+1} = (3^2)^{4x}$ . When raising a power to a power, the powers are multiplied:  
 $(3^3)^{2x+1} = (3^2)^{4x}$   
 $3^{6x+3} = 3^{8x}$  The bases are equal. Set the powers equal to each other and solve for  $x$ .  
 $6x+3=8x$  Subtract 6x from both sides.  
 $3=2x$  Divide both sides by 2.  
 $\frac{3}{2}=x$  **ANSWER:  $x = \frac{3}{2}$**

- 23)  $3x^2 - 2x + k = 0$  When the discriminant  $b^2-4ac$  is negative, then the equation will have imaginary roots. In this equation,  $a=3$   $b=-2$  and  $k$  is unknown. So all you have to now do is set  $b^2-4ac$  to less than 0, which in essence makes it negative.  
 $b^2-4ac < 0$  Substitute  
 $(-2)^2 - 4(3)(k) < 0$   
 $4 - 12k < 0$  Subtract 4 from both sides.  
 $-12k < -4$  Divide both sides by  $-12$ . Remember to switch the inequality symbol!  
 $k > \frac{1}{3}$  **ANSWER:  $k > \frac{1}{3}$**

- 24)  You are asked for the image of triangle EOA after it is reflected through line  $l$ . I have darkened triangle EOA and line  $l$ . Imagine folding square ABCD along its diagonal DB (which is line  $l$ ). Triangle EOA will end up right over triangle HOC. In other words, **triangle HOC is the image of triangle EOA after a reflection in the line  $l$ .**  
**The reflection is an opposite isometry because the orientation of its vertices which started out clockwise (EOA) has now been reversed and is now counterclockwise (HOC).**

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25)



To do an indirect proof, you assume the opposite and then show that the assumption leads to a contradiction. In this case, let us assume that  $AT$  is perpendicular to  $CD$ . This would make  $\angle ATB$  a right angle. A right angle equals 90 degrees. You are given that  $\overline{AB} \perp \overline{CD}$  therefore,  $\angle ABT$  is also a right angle.

The sum of the 3 angles of a triangle add up to  $180^\circ$ . You already have 2 angles of this triangle adding up to  $180^\circ$ !

This can not be! Therefore, your assumption that  $AT$  is perpendicular to  $CD$  can not be true. In other words,  $AT$  is not perpendicular to  $CD$ .

- 26) You are given the equation:  $V = 20\sqrt{C+273}$   
 You are told that  $V$  is the speed of sound which the problem tells us is 320.  
 $C$  is the air temperature. You are being asked to solve for  $C$  when  $V$  is 320.

$V = 20\sqrt{C+273}$	Substitute.
$320 = 20\sqrt{C+273}$	Divide both sides by 20.
$16 = \sqrt{C+273}$	Square both sides.
$256 = C + 273$	Subtract 273 from both sides.
$-17 = C$	

**ANSWER:  $C = -17$**

- 27) You are given the formula  $L = 6,077 - 31 \cos 22$ . You are asked to find  $2$  to the nearest degree when the length of a nautical mile  $L$  equals 6,076. Here's the easiest way to find  $2$

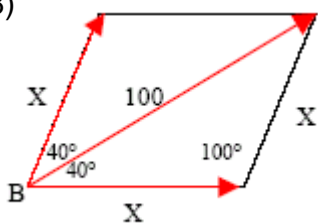
$L = 6,077 - 31 \cos 22$	Substitute.
$6,076 = 6,077 - 31 \cos 22$	Subtract 6077 from both sides.
$-1 = -31 \cos 22$	Divide both sides by $-31$ .
$\frac{1}{31} = \cos 22$	Now comes the tricky part. Which angle has a cos of $\frac{1}{31}$ ?

Use the  $\cos^{-1}$  key to get your answer.

The answer will be 88.15142835. But wait! that is not  $2$ . That is really  $22$ . We were working with  $22$  the whole time. To find  $2$  all we have to do is divide our answer by 2. We end up with 44.07571418. **To the nearest degree it is  $44^\circ$ .**

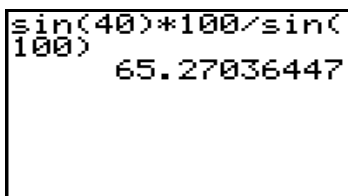
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28)



Imagine you have two equal forces. Let's call them X. They are acting on a body at an angle of 80°. The resultant force is given as 100 newtons. Complete the parallelogram. Since angle B is 80, its adjacent angle, which I've entered in the diagram, is 100. You should notice immediately that the diagram at the left is a rhombus because it is parallelogram whose adjacent sides are equal. The diagonals in a rhombus bisect its angles. That is why you see two 40° angles rather than an 80°. At this point we can

use the law of sines to solve for X.  $\frac{100}{\sin 100} = \frac{X}{\sin 40}$  Cross multiply.



100 sin 40 = X sin 100 Divide both sides by sin 100.

$$\frac{100 \sin 40}{\sin 100} = X$$

Now simply use your calculator to multiply sin 40 by 100 and then divide by sin 100.

**ANSWER: 65.27**

29) You are asked to solve the following equation for x, and to express your answer in simplest radical form:  $\frac{4}{x} - \frac{3}{x+1} = 7$  First let's get rid of the denominators by multiplying each term by (x)(x+1).

$$(x)(x+1)\left(\frac{4}{x}\right) - (x)(x+1)\left(\frac{3}{x+1}\right) = (x)(x+1)(7)$$
 Cancel equal factors

$$(x+1)(4) - (x)(3) = (x)(x+1)(7)$$
 Complete the multiplications.

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

$$4x + 4 - 3x = 7x^2 + 7x$$
 Combine like terms.

$$x + 4 = 7x^2 + 7x$$
 Subtract x from both sides.

$$4 = 7x^2 + 6x$$
 Subtract 4 from both sides.

$$0 = 7x^2 + 6x - 4$$
 You now have a quadratic equation.

$$7x^2 + 6x - 4 = 0$$

$$a=7 \quad b=6 \quad c=-4$$

Use the quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Substitute the values for a, b, and c.

$$x = \frac{-6 \pm \sqrt{6^2 - 4(7)(-4)}}{2(7)} = \frac{-6 \pm \sqrt{36 + 112}}{14} = \frac{-6 \pm \sqrt{148}}{14} = \frac{-6 \pm \sqrt{4} \sqrt{37}}{14} = \frac{-6 \pm 2\sqrt{37}}{14} = \frac{-3 \pm \sqrt{37}}{7}$$

**ANSWER =  $\frac{-3 \pm \sqrt{37}}{7}$**

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- 30) You are presented with the equation  $y = -16x^2 + 48x + 6$  where  $y$  represents height in feet, and  $x$  represents time in seconds. You are throwing the ball from a height of 6 feet and want to know when the ball will again be 6 feet above the ground. This can easily be answered by using your calculator. Make sure to write down on your answer sheet what steps you have taken to answer this question. Input the equation using the  $y=$  editor key. Here are the key strokes and what your calculator screen will look like:

$Y=$   $(-)$   $1$   $6$   $X,T,2n$   $x^2$   $+$   $4$   $8$   $X,T,2n$   $+$   $6$

```

Plot1 Plot2 Plot3
Y1=-16X^2+48X+6
Y2=
Y3=
Y4=
Y5=
Y6=
Y7=
    
```

Now let's see what the table for this parabola would look like. First let's do a table setup. Let's start from 0 and go in increments of 1. Here are the instructions for your calculator:

$2^{nd}$  **WINDOW** Make sure your window looks as follows.

```

TABLE SETUP
TblStart=0
ΔTbl=1
Indent: Auto Ask
Depend: Auto Ask
    
```

Now hit  $2^{nd}$  **GRAPH**

X	Y1
0	6
1	38
2	38
3	6
4	-58
5	-154
6	-282

X=0

The screen all the way to the right is showing that at 0 seconds, the ball was at a height of 6 feet. It also shows you that at **3 seconds it will again be a height of 6.**

We are dealing here with a parabola which means that there will be an axis of symmetry. You see that the maximum height will be attained between 1 and 2 seconds. That means at 1.5 seconds which is the average of 1 and 2. Here is one way you can now find the maximum height. Assign (store) the value of 1.5 for  $x$ , input the equation, and hit enter.  $1$   $.$   $5$  **STO**  $X,T,2n$  **ENTER** Now input the equation the same way as you did when you typed it into the  $y=$  editor and you will arrive at the answer of **42**.

Here is a screen capture of what your screen looks like. In essence what you have just done was to solve your equation when  $x$  is equal to 1.5. Another way of finding the maximum height was to recall that you can obtain the  $x$  value of this point by solving  $-b/2a$ .

```

1.5→X
-16X^2+48X+6    1.5
                  42
    
```

In our case,  $a=-16$   $b=48$ .

$$-b/2a = -48/(2)(-16) = -48/-32 = 1.5$$

And again, once you have the 1.5 all you do is substitute it for  $x$  in the original equation and you will arrive at 42.

Here is how you can write your answer to the first part of this question on the Regents sheet:  
*I entered the equation using the  $y=$  key. Then I checked the list of values at the table window by accessing the TABLE window and saw that as the problem states, at 0 seconds the ball is at a height of 6 feet. The table indicates that it will again be at a height of 6 at 3 seconds.*

**ANSWER: 3 and 42**

## ANSWERS MATH B – June 22<sup>nd</sup> 2004

- 31) You are presented with the following formula:  $A = A_0 2^{\frac{-t}{5760}}$   
 Now read the problem carefully and you will see that A represents the amount of carbon-14 the specimen contains. You are told that the specimen now contains 100 milligrams. When we set up our equation, remember **A=100**.  
 $A_0$  represents the original amount of carbon-14 and we are told that in our problem it is equal to 120 milligrams. So now remember also that  **$A_0=120$**   
 You are asked for the age of the specimen. That is represented by t. In other words, all you have to do now is substitute the two values that we know into the equation and solve for t.

$$A = A_0 2^{\frac{-t}{5760}} \quad \text{After substituting the values we know:} \quad 100 = 120 \left( 2 \right)^{\frac{-t}{5760}}$$

Use your logarithm laws to rewrite the above equation:

$$\log 100 = \log 120 + \left( \frac{-t}{5760} \right) (\log 2) \quad \text{Subtract } \log 120 \text{ from both sides.}$$

$$\log 100 - \log 120 = \frac{-t}{5760} (\log 2) \quad \text{Divide both sides by } \log 2.$$

$$\frac{\log 100 - \log 120}{\log 2} = \frac{-t}{5760} \quad \text{Multiply both sides by } 5760.$$

$$(5760) \frac{\log 100 - \log 120}{\log 2} = -t \quad \text{Use your calculator and simply subtract}$$

$\log 120$  from  $\log 100$ . Divide the answer by  $\log 2$ . Multiply by 5760. Here is how it will look on your screen:

```
log(100)-log(120) This first line is the instruction: log 100 – log 120.
)
```

```
  -.079181246 This is your answer..
```

```
Ans/log(2) The answer is divided by log 2
```

```
  -.2630344058 This is the result so far
```

```
Ans*5760 That result is multiplied by 5760
```

```
 -1515.078178 The answer you see at the left is equal to -t. -t is equal to 1515.078178. To the nearest hundred years the answer is
```

**1500 years.** You really could have entered the complete

problem into the calculator and then hit enter once to get your answer, but it would have been very easy to forget all the parenthesis that would have been necessary to ensure the proper order of the required calculations. Here is what it would have looked like:

```
(5760)(log(100)-
log(120))/log(2)
-1515.078178
```

**ANSWER: 1500 years**

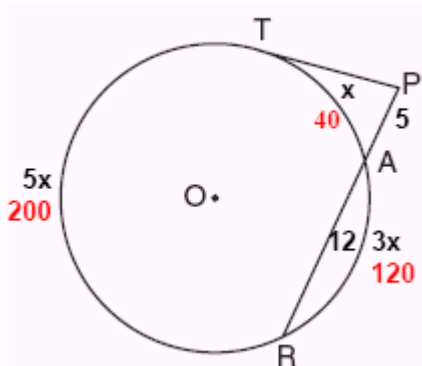
**ANSWERS MATH B – June 22<sup>nd</sup> 2004**

- 32) The mean (average) sale price is given as \$150,000. The standard deviation is \$25,000. This means that houses that cost \$175,000 are 1 standard deviation above the mean.  $\$150,000 + 25,000 = 175,000$ . Based on the bell curve included on your formula page you can see that 34.1% of the scores are 1 standard deviation above the mean. Well, since the mean is at 50%, the \$175,000 which is one standard deviation above the mean is therefore at  $50+34.1\%$  or **84th percentile to the nearest whole number. This means that 84% of the houses sell for \$175,000 or less.**

Just as \$175,000 is one standard deviation above the mean, \$125,00 is one standard deviation below the mean. (Because the mean as stated is \$150,000, and the standard deviation is \$25,000, and  $150,000 - 25,000 = \$125,000$ ).

The numbers that Mrs. Ramirez picked, \$125,000 to \$175,000 are one standard deviation above and below the mean. Mrs. Ramirez is therefore correct. **Houses selling for between \$125,000 - \$175,000 do account for most sales as they account for 68.2% of the sales as based on the standard normal curve.**

- 33) This problem made lots of people unhappy as it is considered a poorly constructed question. There were many different correct answers based on how one ended up understanding the question. Here is one solution that was acceptable.



I have indicated all that is given based on the information presented in the problem. The  $x$ ,  $3x$ , and  $5x$  are there because those arcs were presented as being in 1:3:5 ratio. A complete circle is  $360^\circ$ , therefore in our example here:

$$\begin{aligned} x + 3x + 5x &= 360 \\ 9x &= 360 \\ x &= 40 \end{aligned}$$

The 3 arcs are therefore 40, 120, and 200. The first question posed is what is the measure of angle P?

$\angle P$  is formed by a tangent and secant. The measure of its angle is equal to  $\frac{1}{2}$  the difference of the intercepted arcs. The difference of the arcs is  $200 - 40$  or 160. One-half of that is 80.  $\angle P = 80^\circ$ .

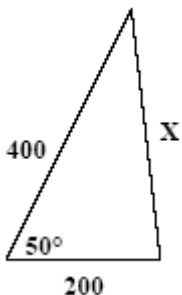
Here is the relationship that you use to find PT which is a tangent:  $(PT)^2 = (PR)(PA)$

Substituting the values, we have  $(PT)^2 = (17)(5)$   $(PT)^2 = 85$   $PT = \sqrt{85}$   $PT = 9.21954$   
To the nearest tenth, the length of PT is 9.2.

**ANSWER: The measure of  $\angle P = 80^\circ$ , and the length of PT is 9.2 centimeters.**

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34)



Pictured at the left is triangular plot of land described in this problem. It consists of two sides with lengths of 200 yards and 400 yards with an angle of 50 between them. The first question is, what is the length of the third side that we can call side X? When you have a triangle and are given two sides and the included angle, and you wish to find the 3<sup>rd</sup> side, use the law of cosines (shown on the formula page).

$a^2 = b^2 + c^2 - 2bc \cos A$  *a, b, and c are the 3 sides of a triangle. Cosine A is the cosine of the angle opposite side a.*

In our case:

$$X^2 = (200)^2 + (400)^2 - 2(200)(400)(\cos 50^\circ)$$

$$X^2 = 40,000 + 160,000 - 160,000 \cos 50^\circ \quad \text{Simplify}$$

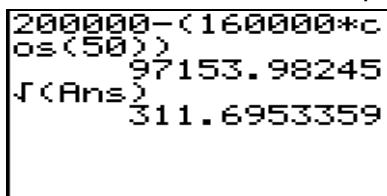
$$X^2 = 200,000 - 160,000 \cos 50^\circ \quad \text{Subtract } 160 \cos 50 \text{ from } 200,000$$

$$X^2 = 97153.98245$$

$$X = 311.6953359$$

**312 to the nearest yard.**

Here is what the above steps would look like on your graphing calculator:



Notice the parenthesis after the minus before the 160000. This ensures that the calculator knows to first calculate 160,000 times the cosine of 50 degrees, and then to subtract that result from 200,000.

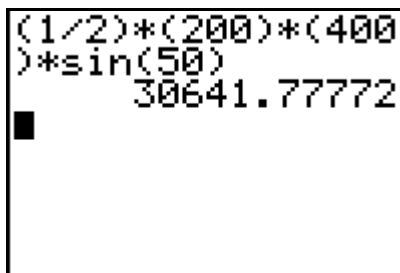
The next part of this question asks for the area of this triangular plot. Again, you can use the formula page to come up with the following equation for the area of a triangle:

$K = \frac{1}{2} ab \sin C$  What this means is that one way you can find the area of a triangle is to multiply to of its sides by the sine of the angle included between them. In our case:

$$K = \frac{1}{2} (200)(400)(\sin 50^\circ) \quad \text{Multiply}$$

$$K = (40000)(\sin 50^\circ) \quad \text{Use your calculator.}$$

**K = 30642 to the nearest square yard.**



This is a screen capture of the screen if you had entered all of the equation without first doing the multiplication on your own.