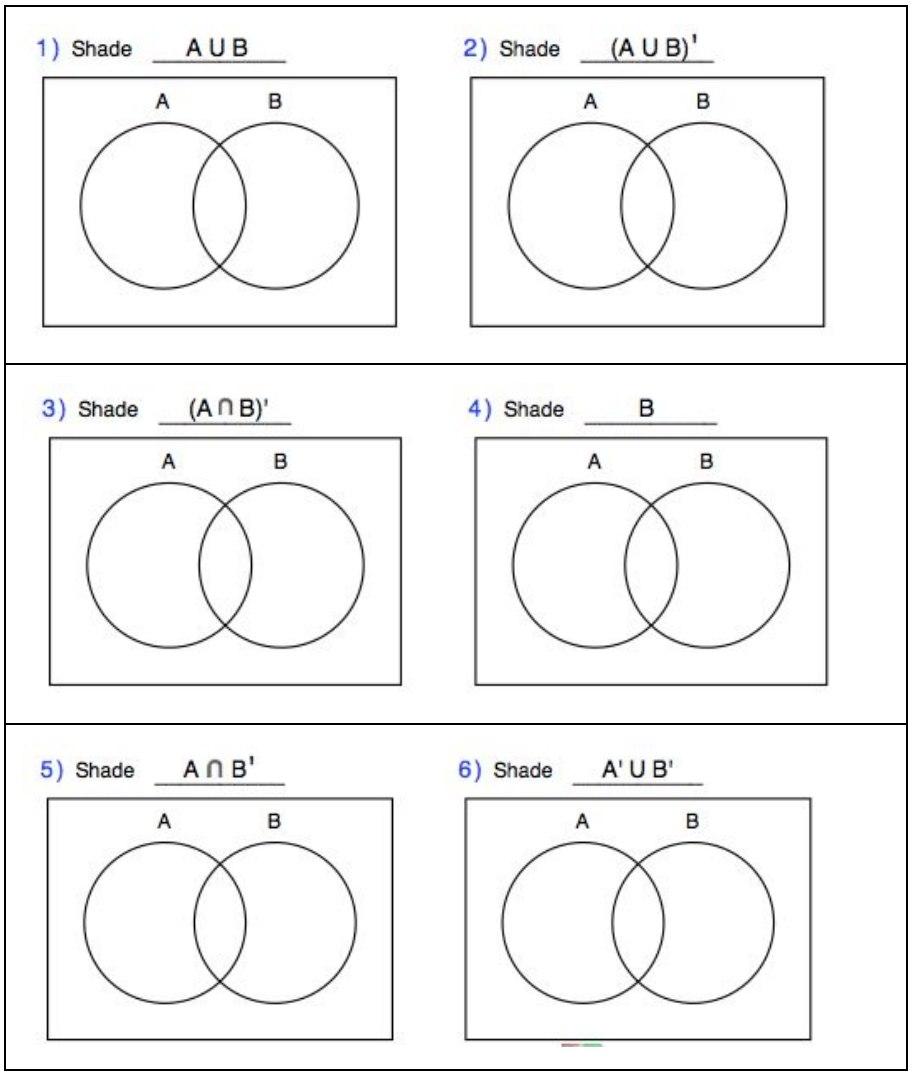
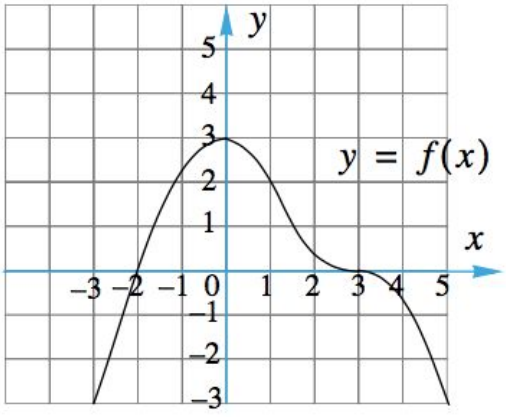
Math SL PROBLEM SET 11

Section A (Short Answer)

1. **(SP5.5 - E) (CI)** Shade the following regions in the Venn diagrams: *(Cirrito 15.2, p508)*



2. **(F2.3 - E) (CI)** The graph of $y = f(x)$ is shown in the diagram. Using a different set of axes for each graph, sketch the graphs of each of the following transformed functions, $g(x)$, showing clearly any intercepts or extrema (maximums or minimums) in the "new" functions. *(Cirrito 6.1, p167; 6.2, p177; 6.3, p183)*



   a. $g(x) = \frac{2}{3}f(x)$
   b. $g(x) = -f(-x)$
   c. $g(x) = f(x + 2) + 1$

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3. **(SP5.1, SP5.2, SP5.3 - R) (CA)** A group of 100 IB students was given a math test that was graded out of 20 points. The following table shows the distribution of the marks obtained: ***(Cirrito 13.2, p471)***

mark	9	10	11	12	13	14	15	16	17	18	19
number of students	1	1	3	5	8	13	19	24	14	10	2

   a. Write down the mode.
   b. Draw a cumulative frequency graph.
   c. Calculate the mean.
   d. Find the median.
   e. Find the upper and lower quartiles
   f. Draw a box & whisker plot for the data.
   g. Another group of 50 students had a mean mark of 17.16 on the same test. Calculate the mean of the entire group of 150 students.

4. **(A1.3, SP5.8 - N) (CA)** Given the binomial expression of $(a + b)^7$: ***(Cirrito 4.1, p95)***

   a. When expanded, the expression is: $(a + b)(a + b)(a + b)(a + b)(a + b)(a + b)(a + b)$. Use this idea to explain **why** the coefficient of the a^3b^4 term is 7 ***nCr*** 3 (or ${}_7C_3$ or $\binom{7}{3}$)
   b. If a represents the probability of selecting a CAC student with a US passport and is equal to 0.42, determine the probability of randomly selecting 3 students with a US passport from a group of 7 CAC students.
   c. Find the coefficient of the x^2 term in the expansion of $(2x - 1)^7$.

5. **(V4.1 - N) (CI)** Vector Addition. Go to the following geogebra animation to find out how to add two vectors. Explain the strategy being used. https://www.geogebra.org/m/HMje3hdt ***(Cirrito 12.3, p415)***

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6. **(V4.1 - N) (CI)** Vector Subtraction: Go to the following geogebra animation to find out how to subtract two vectors. Explain the strategy being used: https://www.geogebra.org/m/vUAFWvmk ***(Cirrito 12.3, p415)***

7. **(V4.1 - N) (CI)** The two previous questions have shown you how to work with **algebraic** vectors. Explain what algebraic vectors are. Then, add/subtract the following vectors, as required: ***(Cirrito 12.3, p415)***

   a. Given that $\vec{a} = 2\vec{i} + 6\vec{j}$ and $\vec{b} = -4\vec{i} + 8\vec{j}$, find and illustrate with a diagram:

      i. $\vec{a} + \vec{b}$

      ii. $\vec{a} - \vec{b}$

      iii. $\vec{b} - \vec{a}$

      iv. $\vec{b} + \vec{a}$

      v. $\overrightarrow{5a}$

      vi. $\overrightarrow{5a} - 2\vec{b}$

   b. The vectors *p* and *q* are defined below as 3D vectors:

The vectors $\boldsymbol{p}$ and $\boldsymbol{q}$ are defined by $\boldsymbol{p} = \begin{pmatrix} -1 \\ -2 \\ 4 \end{pmatrix}$ and $\boldsymbol{q} = \begin{pmatrix} 6 \\ 1 \\ 2 \end{pmatrix}$. Find:

(i) $\boldsymbol{p} + 2\boldsymbol{q}$ (ii) $-3\boldsymbol{p} - 5\boldsymbol{q}$ (iii) $3\boldsymbol{p}$ (iv) $2\boldsymbol{p} + 3\boldsymbol{q}$

Section B (Extended Response/Investigation)

8. **(F2.6 - R) (CA)** Investigating Compound interest and **the natural base**, e. ***(Cirrito 7.1.5, p207)***

   a. Determine the future value of a $10,000 investment that has been earning 5% p.a. compounded monthly for 6 years.

   b. A population of fish in the Nile River is modelled by the equation $P(t) = 120e^{0.075t}$, where t is time in years since January 1st of the year 2000 and $P(t)$ is in thousands.

      i. How many fish are there in the Nile today (end of Sept of 2017)?

      ii. When will the population of fish be 720,000?

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c. Complete the following "investigation" and explain what the idea of continuous compounding means? Where do we get the base "e" from???

GIVEN: the formula for working with compound interest ➔ $FV = PV\left(1+\frac{i}{n}\right)^{nt}$, determine the value after 1 year of a $1 investment invested at 100% pa under the following compounding conditions: **(NOTE: set up on TI-84 as well)**

(a) 100% pa compounded annually	
(b) 100% pa compounded semi-annually	
(c) 100% pa compounded quarterly	
(d) 100% pa compounded monthly	
(e) 100% pa compounded daily	
(f) 100% pa compounded hourly	
(g) 100% pa compounded every minute	
(h) 100% pa compounded every second	
(i) 100% pa compounded n times per year	

FINAL QUESTION? ➔ BY WHAT **RATIO** HAS YOUR MONEY INCREASED IN VALUE?