

# Math SL PROBLEM SET 12

## Section A (Short Answer)

1. **(T3.1 - N) (CA)** There is another way to measure angles in trigonometry. Let us examine this new method. A circle has  $360^\circ$ , a circle can also be said to have  $2\pi$  *radians*. Using this information answer the following questions: **(Cirrito 9.7.1, p309)**

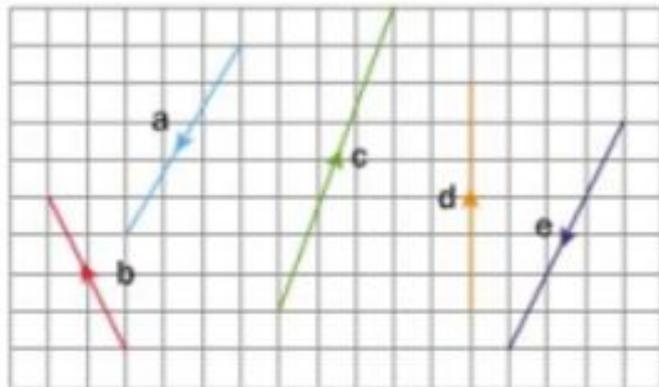
- a. Convert these angles from degrees into radians:
- $75^\circ$
  - $240^\circ$
  - $90^\circ$
- b. Convert these angles from radians into degrees:
- $\frac{\pi}{3}$
  - $\frac{3\pi}{4}$
  - $\pi$

2. **(C6.1 - N) (CA)** Recall that an average rate of change between any two points on a function can be determined using the difference quotient  $\frac{f(x_2) - f(x_1)}{x_2 - x_1}$ . Find the average rate of change in the following examples. Sketch a diagram in each case. **(Cirrito 18.1.2, p582)**

- In the function  $f(x) = x^2 + 2x - 1$  between  $x = 0$  and  $x = 2$ .
- Determine the equation of the this line through  $x = 0$  and  $x = 2$  and graph this line on your calculator.
- Use the calculator to draw the tangent line at  $x = 1$ .
- What do you notice about your answers to Q(a) and Q(c)?

3. **(V4.1 - N) (CI)** Go on line and find a definition for a vector. Note that mathematically, vectors can be written in many forms, two common ones being *column vector form* and *base vector form* (also known as *unit vector form*). **(Cirrito 12.2, p410)**

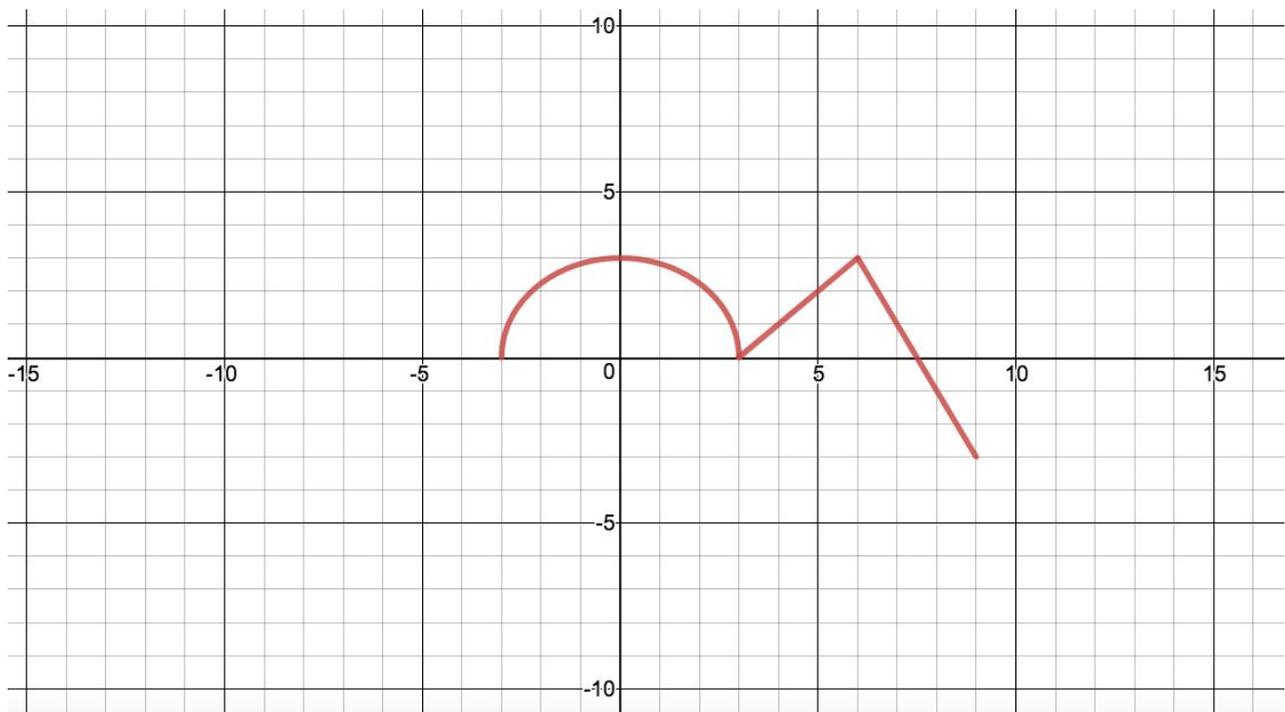
- Given the following diagram, write the following vectors in both column vector form and unit vector form.
- How would you determine the magnitude of vector  $\mathbf{a}$ ? What is its magnitude?



4. **(SP5.5 - E) (CI)** To get out of jail free in the board game MONOPOLY®, you have to roll doubles with a pair of standard dice. Determine the probability of getting out of jail on your first or second roll. **(Oxford 3.3, p77)**

# Math SL PROBLEM SET 12

5. **(T3.2, T3.3 - N) (CI)** Let  $\sin \theta = \frac{\sqrt{5}}{3}$ , where  $\theta$  is acute. **(Cirrito 10.1.2, p316)**
- Which quadrant is  $\theta$  in?
  - Find  $\cos \theta$  and  $\tan \theta$ .
  - Show that  $\tan \theta = \sin \theta / \cos \theta$ .
  - Find the value of  $\sin^2 \theta + \cos^2 \theta$ .
6. **(F2.3 - R) (CI)** Here is a graph of  $y = f(x)$ . Given the following mappings, identify the:
- Transformations being communicated;
  - Transform  $y = f(x)$  and provide a graph of the new function (label critical points in your new graphs)
- $g(x) = f(\frac{1}{2}(x - 10))$
  - $g(x) = -2f(-x)$



## Section B (Extended Response/Investigation)

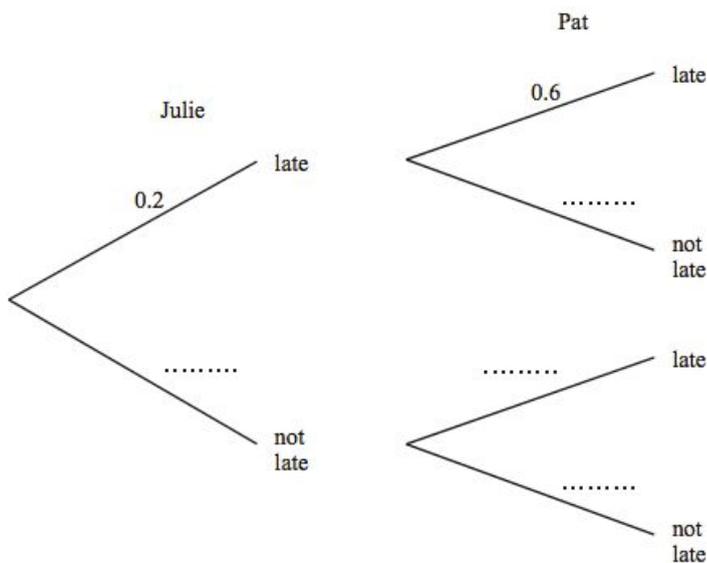
7. **(A1.3, SP5.8 - N) (CA)** To investigate the “binomial expansion”, work through the following questions. Use WOLFRAMALPHA to help with the expansions if you wish. **(Cirrito 4.1.1, p95)**
- Expand and simplify  $(a + b)^0$ .
  - Expand and simplify  $(a + b)^1$ .
  - Expand and simplify  $(a + b)^2$ .
  - Expand and simplify  $(a + b)^3$ .
  - Expand and simplify  $(a + b)^4$ .
  - Expand and simplify  $(a + b)^5$ .

# Math SL PROBLEM SET 12

- g. A useful strategy in math is to look for patterns and then make predictions from those patterns. PREDICT the expansion and simplification of  $(a + b)^7$ .
- h. Recall your expansion of  $(a + b)^4$  from Qe. Use this expansion to PREDICT the expansion of  $(3x^2 - 4)^4$ .
- i. Go online to find out what the term “binomial probabilities” implies and means.
- j. Now, let  $a$  represent the probability that a randomly selected student in SL math passes math and is equal to 0.8 and let  $b$  represent the probability that a randomly selected student DOES NOT pass math and is equal to 0.2.
  - i. Explain why  $a + b$  must be equal to 1.
  - ii. Recall your expansion of  $(a + b)^4$  from Qe. Write it out again here.
  - iii. Explain how you would use your expansion to help determine the probability of the following event  $\Rightarrow$  I randomly select 4 students and i want to know how probable it is that 2 of these students will pass math.

8. **(SP5.5, 5.6 - R) (CI)** Julie and Pat are going to the cinema. Let  $A$  be the event that Julie will arrive late and  $P(A)$  is 0.2 Let  $B$  be the event that Pat will arrive late and  $P(B)$  is 0.6 The two events are independent. *(Oxford 3.5, p89)*

- a. Explain what “independence” means in this context.
- b. Complete the tree diagram, showing this information.



- c. Work out the probability that Julie and Pat will both arrive late.
- d. Work out the probability that either Julie or Pat will arrive late.
- e. Complete a Venn diagram, showing this information.
- f. Use the formula  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$  and explain what the answer means. Compare to your answer from Qd.