

# Math SL PROBLEM SET 1

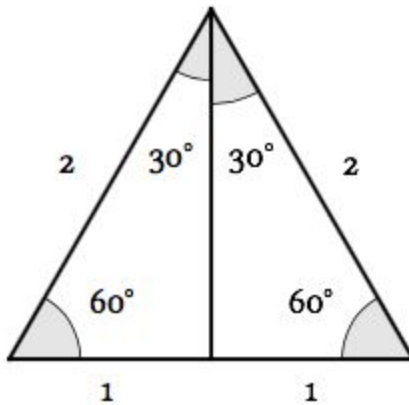
---

## Section A

1. **(F2.4 - R)** (CI) Given the quadratic function  $f(x) = 4x^2 - 4x - 15$ . *(Cirrito 2.4.2, p44)*

- Find the zeroes of this function.
- Find the optimal point of this function.
- Is this optimal point a maximum or minimum? Show/explain your reasoning.

2. **(T3.2 - R)** (CI) By considering an equilateral triangle with side length 2, find in exact form the values of  $\sin 30$ ,  $\cos 30$ ,  $\tan 30$ ,  $\sin 60$ ,  $\cos 60$ ,  $\tan 60$ . *(Cirrito 10.1.1, p315)*



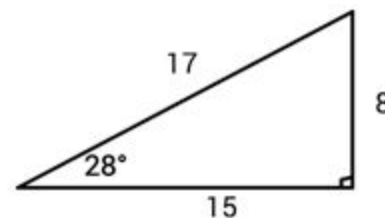
3. **(T3.4, T3.5 - R)** (CI) Given the function  $g(\theta) = 2 \sin(\theta) + 1$  on the domain of  $0^\circ \leq \theta \leq 360^\circ$ , *(Cirrito 10.4.1, p351)*

- Find the zeroes of this function. (HINT: special triangles?)
- Determine the range of this function.

# Math SL PROBLEM SET 1

4. **(F2.1, F2.4, F2.7 - R)** (CI) Given the quadratic function  $Q(x) = 3(x - 1)^2 + 5$ ; (*Cirrito 2.4.1, p39; Cirrito 2.4.2, p44*)
- Determine the equation of the inverse function.
  - Write the equation for  $Q(x)$  in standard form.
  - Given your work in Q(b), find the value of the discriminant of  $Q(x)$ .
  - Explain the graphical significance of the **sign of your discriminant**, given your answer to Q(c).
  - The graphical significance you just noted about the sign of the discriminant of  $Q(x)$  could have been determined from **the original function as presented** (as  $Q(x)$ ). Explain how you could have made the same conclusion from the form .

5. **(T3.2, T3.4 - R)** (CI) You are given this special right triangle as well as the measure of one of its angles. Use this diagram to answer the following questions. (*Cirrito 10.1.2, p316*)



- Evaluate the following:
  - $\cos(28^\circ)$
  - $\tan^{-1}\left(\frac{15}{8}\right)$
- Use this special triangle and your knowledge of angles in standard position to evaluate  $\sin(332^\circ)$ .
- The terminal arm of the angle goes through the point  $A(-8, -15)$  . Draw the angle and label the principal angle and the related acute angle.
- Explain WHY Sara knows that the measure of the principal angle in Q(c) is  $242^\circ$ .

# Math SL PROBLEM SET 1

---

## Section B

6. **(F2.5, F2.7, F2.8, T3.6 - R; A1.3 - N)** (CA) Mr. S's sister is the publisher of a magazine. To model the **monthly revenues**, she uses the equation  $R(t) = -0.025t(t - 30)(t^2 - 31t + 250)$ , where  $R$  is revenues (in hundreds of dollars) and  $t$  is the number of months since she began the business, on Jan 1<sup>st</sup>, 2015. She models the **monthly expenses** using  $E(t) = 100 + \frac{200(t+2)}{t+5}$ , where  $E$  is expenses (in hundreds of dollars) and  $t$  is, again, the number of months since she began the business.

(To clarify again:  $t = 0$  is January 1<sup>st</sup> and  $t = 1$  is Feb 1<sup>st</sup> and  $t = 4.75$  would be 4 complete months and then  $\frac{3}{4}$  of the way through the 5<sup>th</sup> month, so 3<sup>rd</sup> week of May and  $t = 29$  would be today, June 1<sup>st</sup>, 2017).

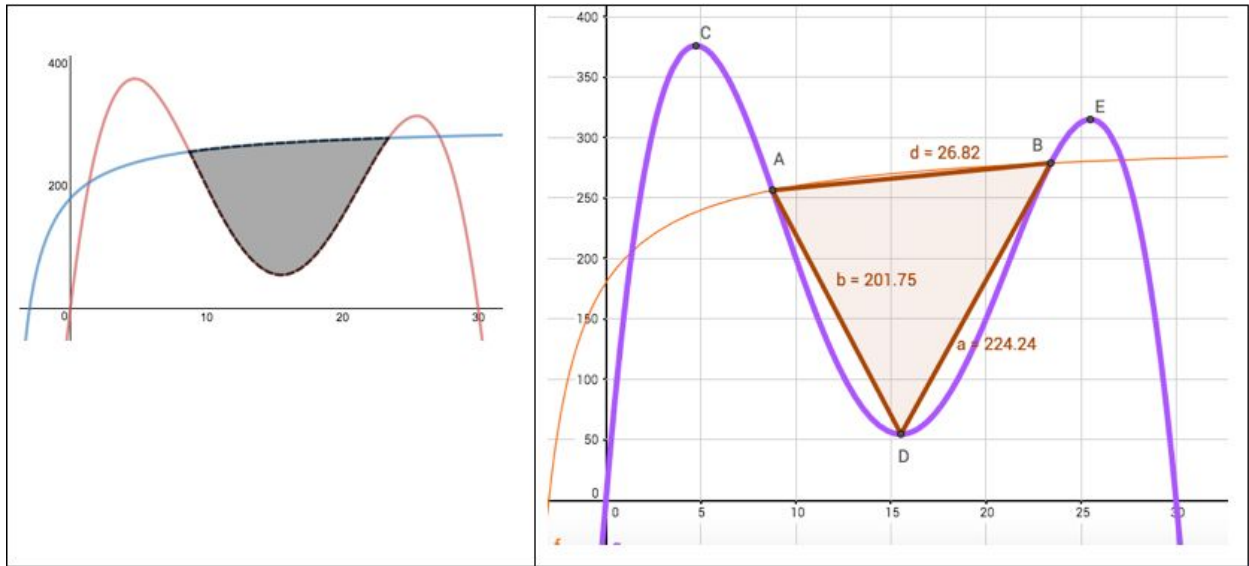
- Determine the equations of the asymptotes of the expense function,  $E(t) = 100 + \frac{200(t+2)}{t+5}$ .
- Explain what the horizontal asymptote of the expenses function,  $E(t)$ , means in the context of this problem.
- Rewrite the equation for  $E(t)$  in the form of  $E(t) = \frac{At+B}{Ct+D}$ .

Recall that **PROFIT** is difference between the revenues and the expenses and for our common understanding, can be either POSITIVE (making money) or NEGATIVE (losing money)

- The inequality  $R(t) \geq E(t)$  can be used to calculate when the business GAINS money (i.e. have positive profits). In what domain interval(s) does the business GAIN money?
- Determine the maximum profit that my sister earned.

To get an idea of the TOTAL LOSSES that she incurred between October ( $t = 9$ ) and Dec the next year ( $t = 23$ ), my sister suggests that I should calculate the AREA between the two functions (see DESMOS diagram). So I used GEOGEBRA to estimate the area as a triangle and get some data (see GEOGEBRA diagram).

# Math SL PROBLEM SET 1



- f. Using the information presented on the GEOGEBRA diagram,
- determine the measure of the angle at D. (NOTE: the graphs are NOT to scale!!!)
  - hence or otherwise, calculate the area of the triangle.
- g. Given your work in Q(f), what is the estimate of my sister's losses in this 14 month period?
- h. She would now like to confirm this estimate by working through the following "formula"  
$$\sum_{i=9}^{23} P(x_i)$$
. Explain what this "formula" means and then use the formula to find the estimate of her losses in this 14 month period.