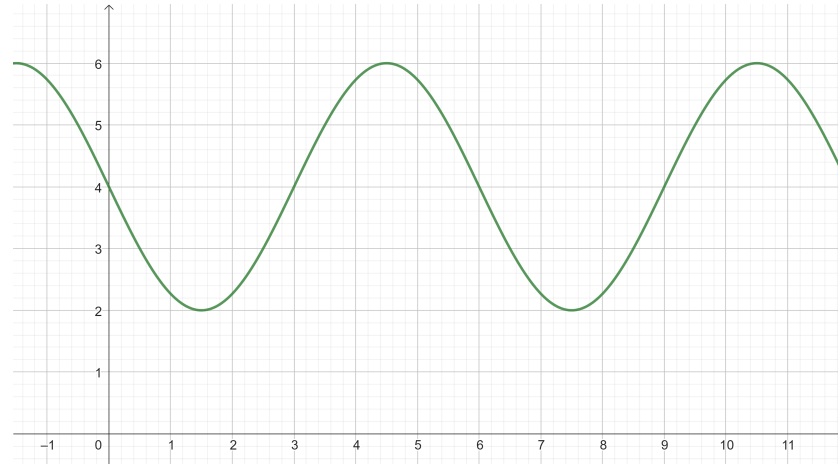


1.

[6 points]

The following diagram shows the graph of $f(x) = a \sin(bx) + d$.



The graph has a y -intercept at 4, a minimum at $(1.5, 2)$ and a maximum at $(4.5, 6)$.

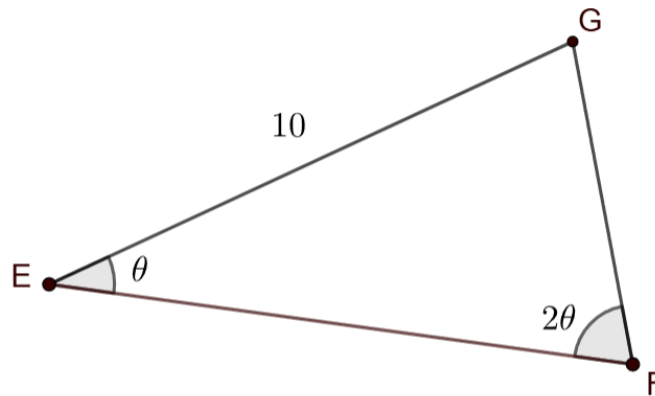
(a) Find the values of a , b and d .

(b) The domain of $f(x)$ is restricted to $1.5 \leq x \leq k$, where k is the largest possible value for which the inverse function exists. State the value of k and find the inverse function.

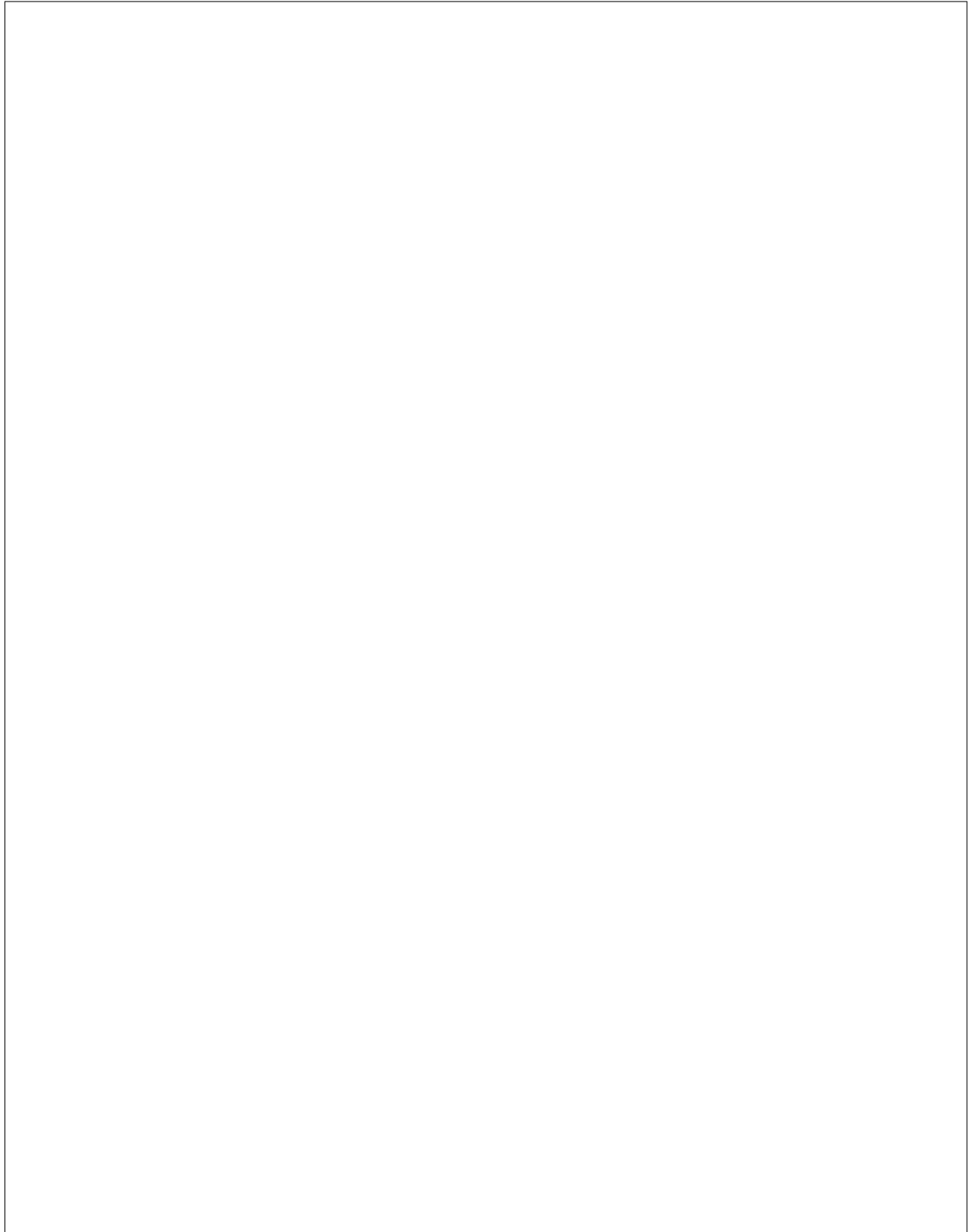
2.

[9 points]

Consider the following triangle:

with $EG = 10$ and $\angle GFE = 2\angle FEG$. Let $\sin \theta = x$.

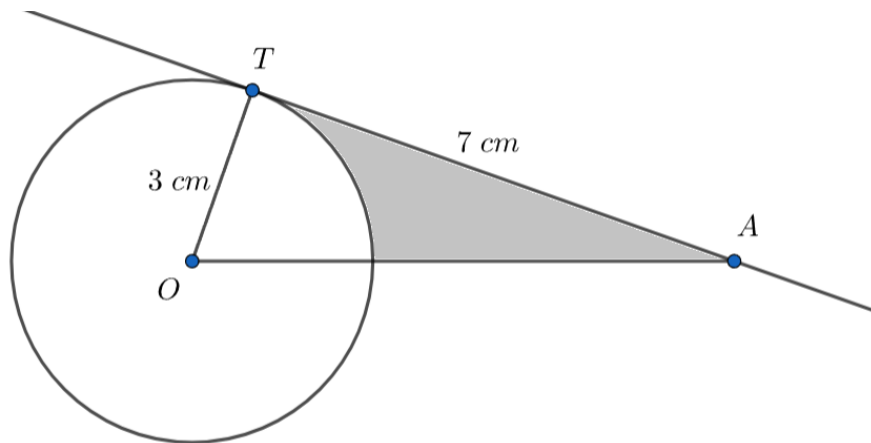
- Express $\sin 2\theta$ in terms of x .
- Hence express GF in terms of x .
- Show that $\sin \angle EGF = 3x - 4x^3$.
- Hence express the area of the triangle in terms of x and find the greatest possible area of the triangle.



3.

[4 points]

Consider a circle with radius 3 cm and a tangent to this circle drawn from point A . Let T be the point of tangency and let $AT = 7\text{ cm}$. The following diagram shows the above information.



Find the shaded area. Give your answer correct to 4 significant figures.

4.

[6 points]

Tomasz is at a point T_1 on level ground. He sees a tower which is 145 metres away on bearing of 040° . The angle of elevation from Tomasz to the top of the tower is 25° . Tomasz walks 120 metres West to a point T_2 .

- (a) Find the distance from T_2 to the foot of the tower.
- (b) Find the bearing of the tower from T_2 .
- (c) Find the angle of elevation from T_2 to the top of the tower.