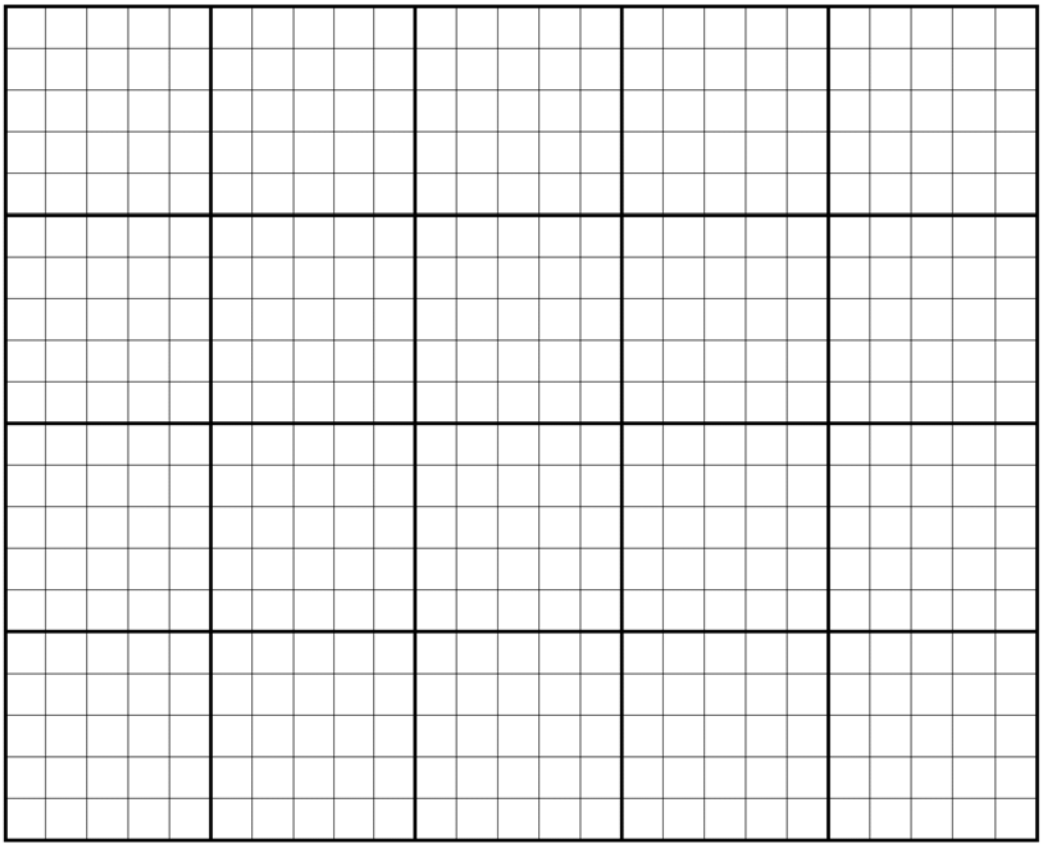
(a) Using the data provided in the table above, **plot** the elephant population data as points on the grid below, placing the independent variable on the *x*-axis. Clearly **label** the axes.



(b) **Calculate** the percent loss of elephants in Africa from 1970 to 2000. Show all work.

(c) The International Union for Conservation of Nature (IUCN) estimates that the elephant population will decline by 20 percent between 2015 and 2022. Use this estimate to **calculate** how many elephants will be left in Africa in 2022. Show all work.

(d) Most large terrestrial mammals are K-strategists. **Identify** one characteristic of a K-strategist and **explain** how the characteristic you identified can make these mammals prone to extinction.

(e) **Identify** and **discuss** TWO conservation strategies that could be implemented to prevent the extinction of large terrestrial mammals, such as the African elephant or snow leopard.

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4. Dams are built by humans for various purposes including hydroelectric power generation and control of downstream flooding.

   (a) **Explain** how electricity is generated at a hydroelectric dam.

   (b) **Identify** TWO economic benefits, other than hydroelectric power generation and control of downstream flooding, associated with dams.

   (c) **Describe** one ecological benefit of seasonal flooding of the floodplain of a free-flowing river.

   (d) Some dams have been removed from rivers.

      (i) **Explain** how removal of a dam can benefit fish populations.

      (ii) **Describe** one negative environmental consequence of removing a dam from a river (other than effects on fish populations).

   (e) Dams are also built by beavers, a keystone species in some North American ecosystems.

      (i) **Define** keystone species.

      (ii) **Describe** how dams built by beavers can make beavers a keystone species in some ecosystems.

STOP

END OF EXAM

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Question 4

Dams are built by humans for various purposes including hydroelectric power generation and control of downstream flooding.

(a) **Explain** how electricity is generated at a hydroelectric dam.

(3 points: 1 point for a description of each step in the process of generating electricity at a hydroelectric dam.)

Step	Description of Step
Water moves	• Water falls/drops • Water is directed to a turbine • Potential energy → kinetic energy
Turbine rotates	• Water turns/rotates a turbine • Kinetic energy → mechanical energy
Electricity produced	• Turbines turn/drive a generator • Rotation converted to electricity • Mechanical energy → electricity

(b) **Identify** TWO economic benefits, other than hydroelectric power generation and control of downstream flooding, associated with dams.

(*2 points: 1 point for each correct identification of an economic benefit. Only the first two identifications can earn a point.*)

- Recreation/tourism
- Job creation
- Provision of water for domestic, industrial, or agricultural use
- Commercial fisheries
- Commercial shipping

(c) **Describe** one ecological benefit of seasonal flooding of the floodplain of a free-flowing river.

(*1 point for a correct description of an ecological benefit of seasonal flooding of the floodplain.*)

- Flooding can deposit nutrients/increase soil fertility
- Sediment can create banks
- Sediment can build/replenish soil
- Overflow can deposit seeds
- Flooding can recharge the aquifer
- Overflow can create/maintain habitat for fish and birds (e.g., riparian zones, wetlands)
- Flooding can decrease soil/water salinization

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Question 4 (continued)

(d) Some dams have been removed from rivers.

(i) **Explain** how removal of a dam can benefit fish populations.

(*1 point for correct explanation of how dam removal benefits fish populations.*)

- Restoration of wetland/riparian habitats supports fish populations
- Removal of barrier allows fish migration/increases access to habitats/mates
- Removal of dam turbines/spillway decreases fish mortality
- Restoration of pre-dam conditions (e.g. water temperature, habitat, dissolved oxygen, turbidity) benefits native species

(ii) **Describe** one negative environmental consequence of removing a dam from a river (other than effects on fish populations).

(*1 point for correct description of a negative environmental consequence of dam removal.*)

- Loss of lake habitat/species or downstream habitat/species following restoration of pre-dam conditions
- Increased deposition of sediment downstream
- Erosion of stream banks by high flow following rapid dam removal
- Increased turbidity from release of silt/sediment
- Movement of pollutants accumulated behind the dam downstream
- Change of water temperatures downstream
- Spread of invasive species

(e) Dams are also built by beavers, a keystone species in some North American ecosystems.

(i) **Define** keystone species.

(*1 point for a correct definition of a keystone species.*)

- Has a large effect on its environment relative to its abundance
- Increases ecosystem stability OR reduces ecosystem stability when absent

(ii) **Describe** how dams built by beavers can make beavers a keystone species in some ecosystems.

(*1 point for a description of how beaver dams transform their environment linked to impact on other species.)*

- Creation of habitats/alteration of existing habitat
- Fewer floods maintains habitat stability
- Removal of water-borne pollutants increases survival of aquatic life
- Entrapment of sediments behind dam creates habitat/reduces turbidity
- Reduction of erosion of stream banks

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