Heart disease Analysis Using EDA Python

Extensive Analysis + Visualization with Python

In [1]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import scipy.stats as st
%matplotlib inline

sns.set(style="whitegrid")
```

In [2]:
```
# ignore warnings

import warnings
warnings.filterwarnings('ignore')
```

In [7]:
```
df = pd.read_csv(r'C:\Users\Mukesh\OneDrive\Desktop\Tanmay Folder\Projects\Heart Di
```

In [8]:
```
# print the shape
print('The shape of the dataset : ', df.shape)
```

```
The shape of the dataset :  (1025, 14)
```

In [9]:
```
# preview dataset
df.head()
```

Out[9]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	t
0	52	1	0	125	212	0	1	168	0	1.0	2	2	3	
1	53	1	0	140	203	1	0	155	1	3.1	0	0	3	
2	70	1	0	145	174	0	1	125	1	2.6	0	0	3	
3	61	1	0	148	203	0	1	161	0	0.0	2	1	3	
4	62	0	0	138	294	1	1	106	0	1.9	1	3	2	

In [10]:
```
# summary of dataset
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1025 entries, 0 to 1024
Data columns (total 14 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   age       1025 non-null   int64  
 1   sex       1025 non-null   int64  
 2   cp        1025 non-null   int64  
 3   trestbps  1025 non-null   int64  
 4   chol      1025 non-null   int64  
 5   fbs       1025 non-null   int64  
 6   restecg   1025 non-null   int64  
 7   thalach   1025 non-null   int64  
 8   exang     1025 non-null   int64  
 9   oldpeak   1025 non-null   float64
 10  slope     1025 non-null   int64  
 11  ca        1025 non-null   int64  
 12  thal      1025 non-null   int64  
 13  target    1025 non-null   int64  
dtypes: float64(1), int64(13)
memory usage: 112.2 KB
```

In [11]:
```
df.dtypes
```

Out[11]:
```
age           int64
sex           int64
cp            int64
trestbps      int64
chol          int64
fbs           int64
restecg       int64
thalach       int64
exang         int64
oldpeak     float64
slope         int64
ca            int64
thal          int64
target        int64
dtype: object
```

In [12]:
```
# statistical properties of dataset
df.describe()
```

Out[12]:

	age	sex	cp	trestbps	chol	fbs	r
count	1025.000000	1025.000000	1025.000000	1025.000000	1025.00000	1025.000000	1025.0
mean	54.434146	0.695610	0.942439	131.611707	246.00000	0.149268	0.5
std	9.072290	0.460373	1.029641	17.516718	51.59251	0.356527	0.5
min	29.000000	0.000000	0.000000	94.000000	126.00000	0.000000	0.0
25%	48.000000	0.000000	0.000000	120.000000	211.00000	0.000000	0.0
50%	56.000000	1.000000	1.000000	130.000000	240.00000	0.000000	1.0
75%	61.000000	1.000000	2.000000	140.000000	275.00000	0.000000	1.0
max	77.000000	1.000000	3.000000	200.000000	564.00000	1.000000	2.0

In [13]:
```
df.columns
```

Out[13]:
```
Index(['age', 'sex', 'cp', 'trestbps', 'chol', 'fbs', 'restecg', 'thalach',
       'exang', 'oldpeak', 'slope', 'ca', 'thal', 'target'],
      dtype='object')
```

In [14]:
```
df['target'].nunique()
```

Out[14]:
```
2
```

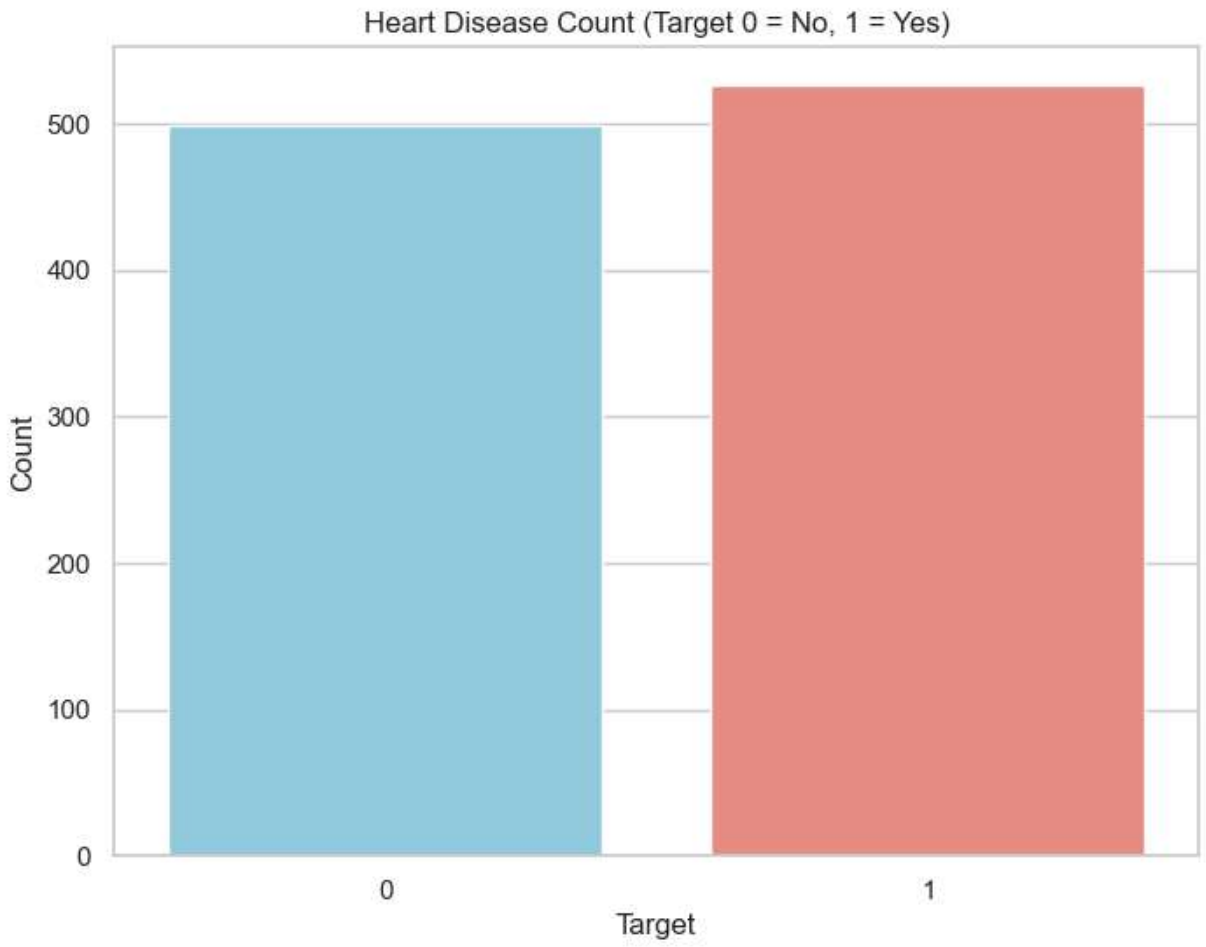
In [15]:
```
df['target'].unique()
```

Out[15]:
```
array([0, 1], dtype=int64)
```

In [16]:
```
df['target'].value_counts()
```

Out[16]:
```
target
1    526
0    499
Name: count, dtype: int64
```

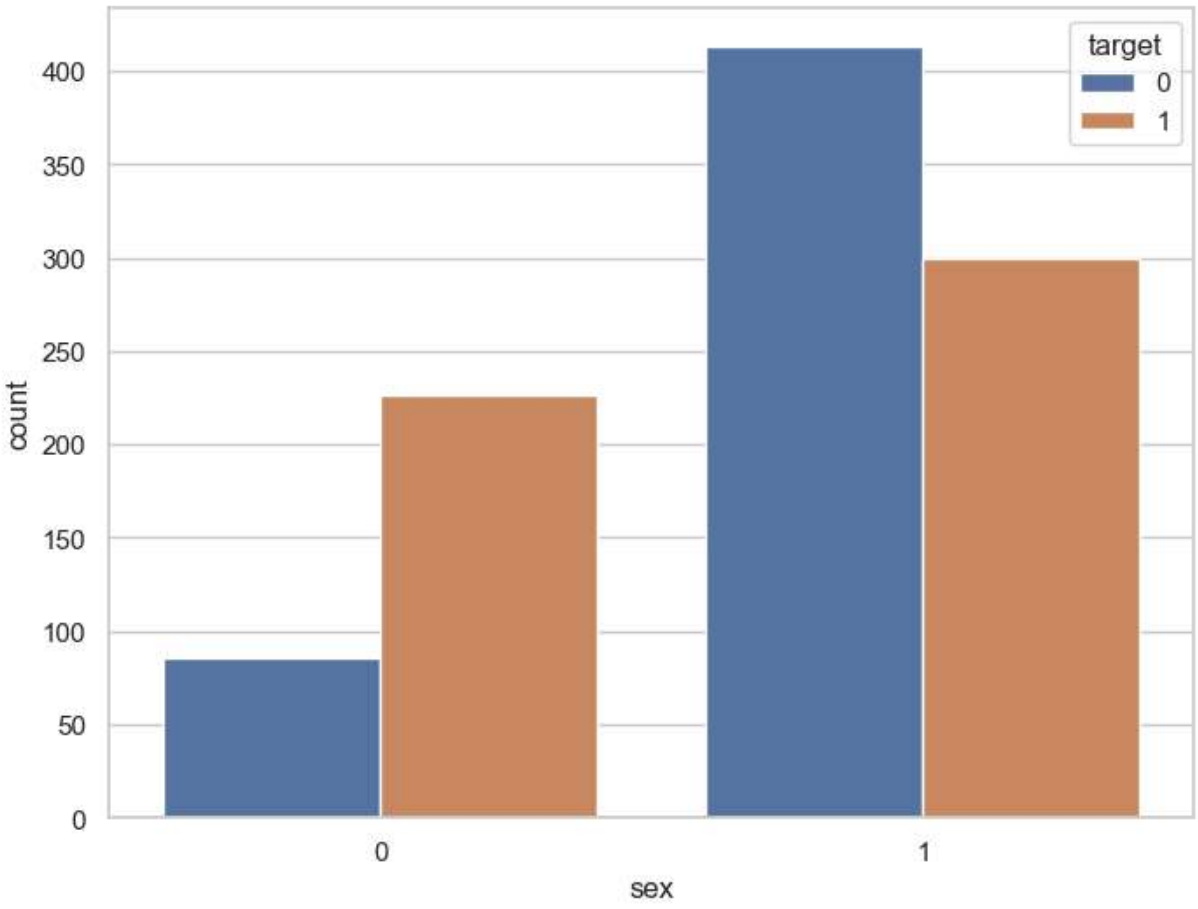
In [24]:
```
# Plot with string keys
f, ax = plt.subplots(figsize=(8, 6))
ax = sns.countplot(x="target", data=df, palette={'0': "skyblue", '1': "salmon"})

plt.title("Heart Disease Count (Target 0 = No, 1 = Yes)")
plt.xlabel("Target")
plt.ylabel("Count")
plt.show()
```



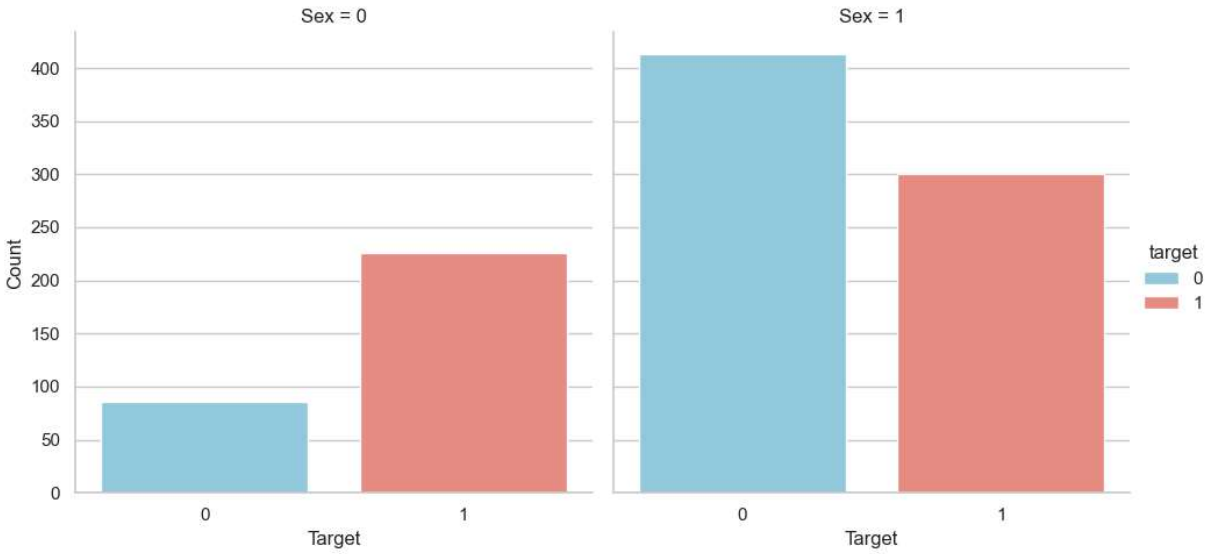
In [25]:
```
df.groupby('sex')['target'].value_counts()
```

Out[25]:
```
sex  target
0    1         226
     0          86
1    0         413
     1         300
Name: count, dtype: int64
```

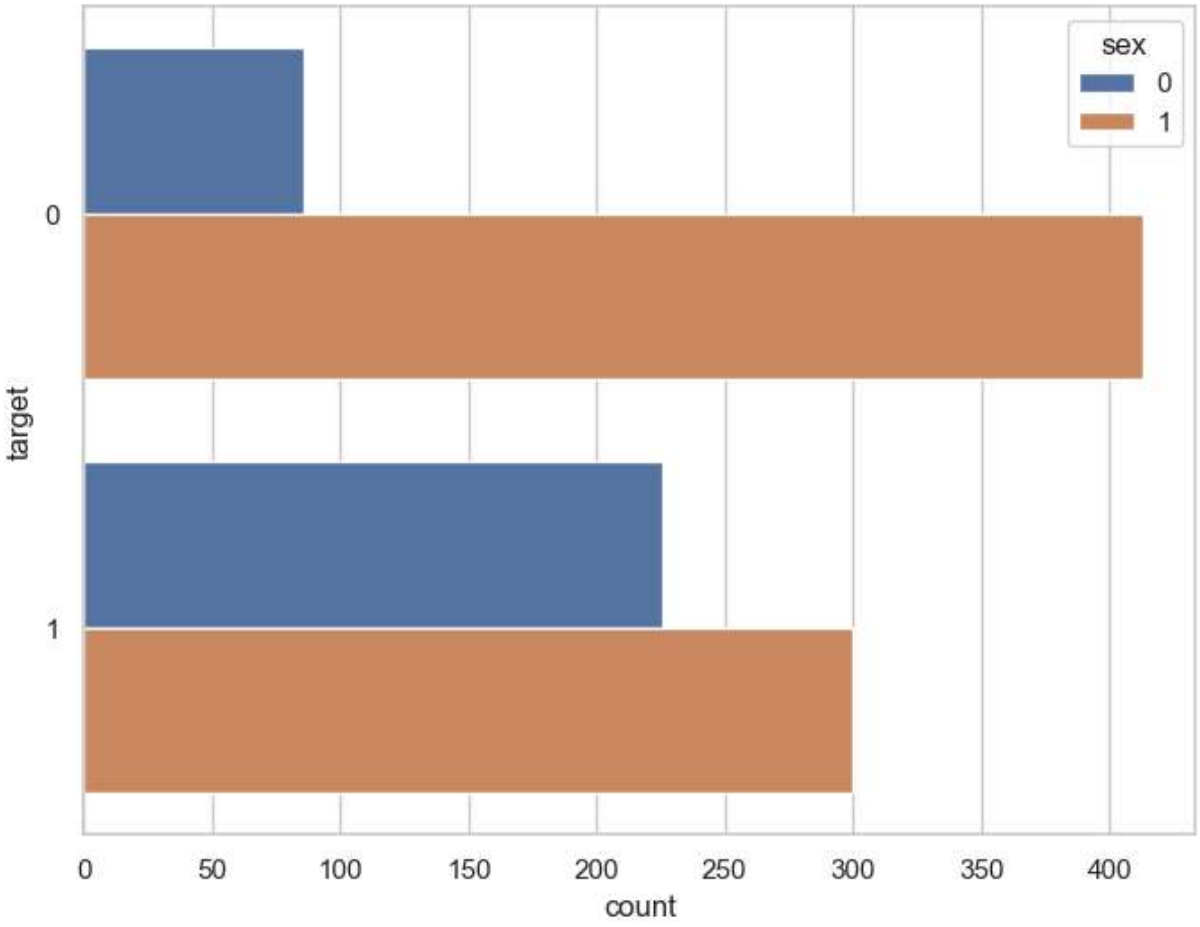
In [26]:
```
f, ax = plt.subplots(figsize=(8, 6))
ax = sns.countplot(x="sex", hue="target", data=df)
plt.show()
```



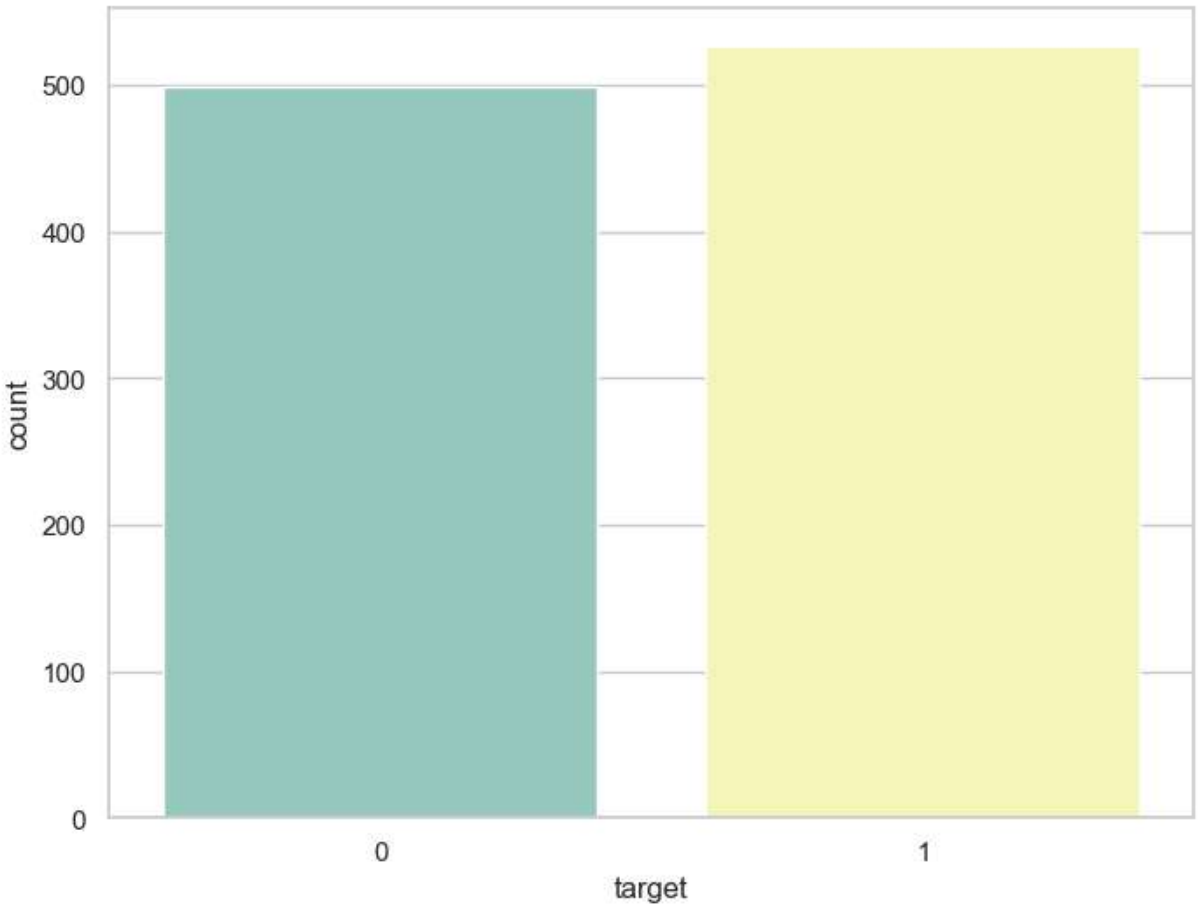
In [32]:
```python
# Convert target to int if it's not already
df["target"] = df["target"].astype(int)

# Use catplot with hue and color palette
ax = sns.catplot(
    x="target",
    col="sex",
    data=df,
    kind="count",
    hue="target",
    palette={0: "skyblue", 1: "salmon"},
    height=5,
    aspect=1
)

# Set titles and labels
ax.set_titles("Sex = {col_name}")
ax.set_axis_labels("Target", "Count")
plt.show()
```



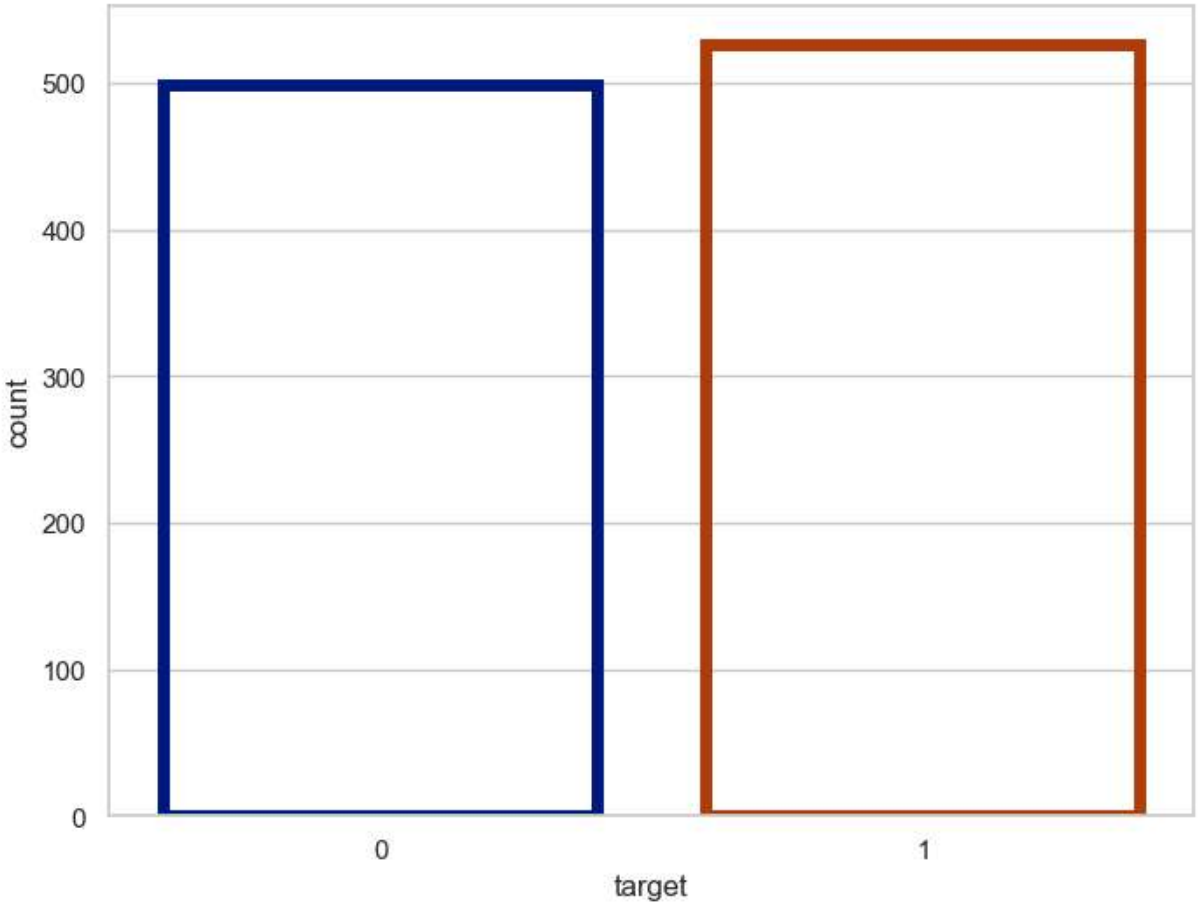
In [33]:
```
f, ax = plt.subplots(figsize=(8, 6))
ax = sns.countplot(y="target", hue="sex", data=df)
plt.show()
```



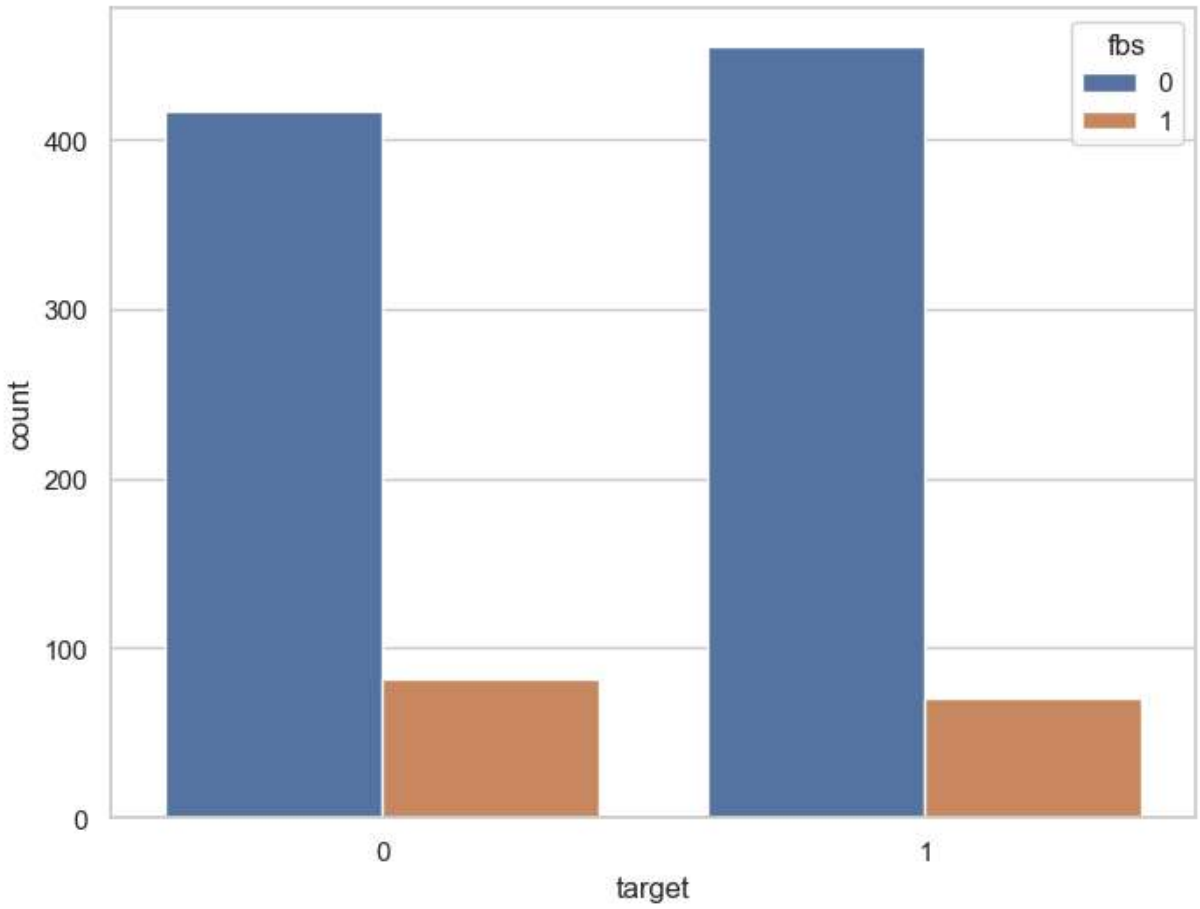
In [34]:
```
f, ax = plt.subplots(figsize=(8, 6))
ax = sns.countplot(x="target", data=df, palette="Set3")
plt.show()
```



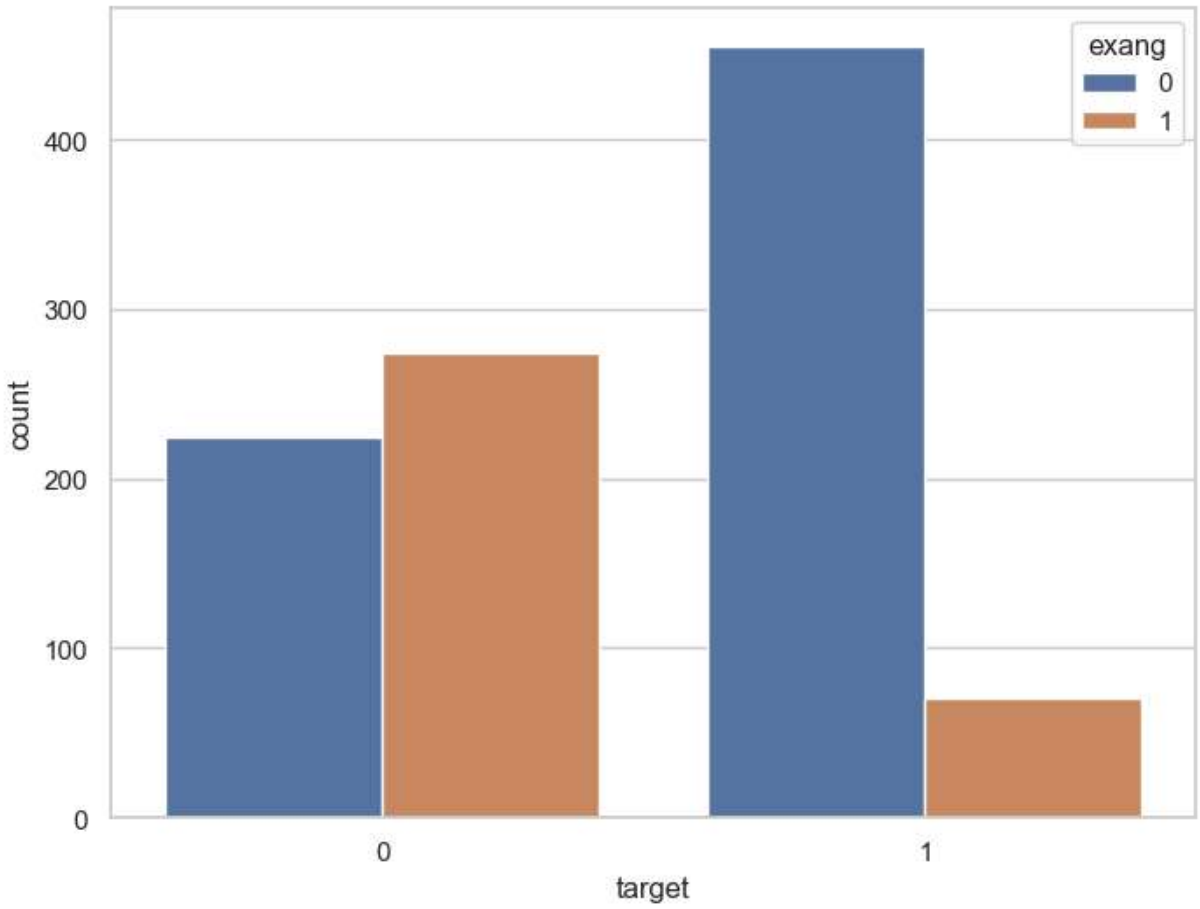
In [35]:
```
f, ax = plt.subplots(figsize=(8, 6))
ax = sns.countplot(x="target", data=df, facecolor=(0, 0, 0, 0), linewidth=5, edgeco
plt.show()
```



In [36]:
```
f, ax = plt.subplots(figsize=(8, 6))
ax = sns.countplot(x="target", hue="fbs", data=df)
plt.show()
```



In [37]:
```
f, ax = plt.subplots(figsize=(8, 6))
ax = sns.countplot(x="target", hue="exang", data=df)
plt.show()
```



In [39]:
```
correlation = df.corr()
```

In [40]:
```
correlation['target'].sort_values(ascending=False)
```

Out[40]:
```
target      1.000000
cp          0.434854
thalach     0.422895
slope       0.345512
restecg     0.134468
fbs        -0.041164
chol       -0.099966
trestbps   -0.138772
age        -0.229324
sex        -0.279501
thal       -0.337838
ca         -0.382085
exang      -0.438029
oldpeak    -0.438441
Name: target, dtype: float64
```

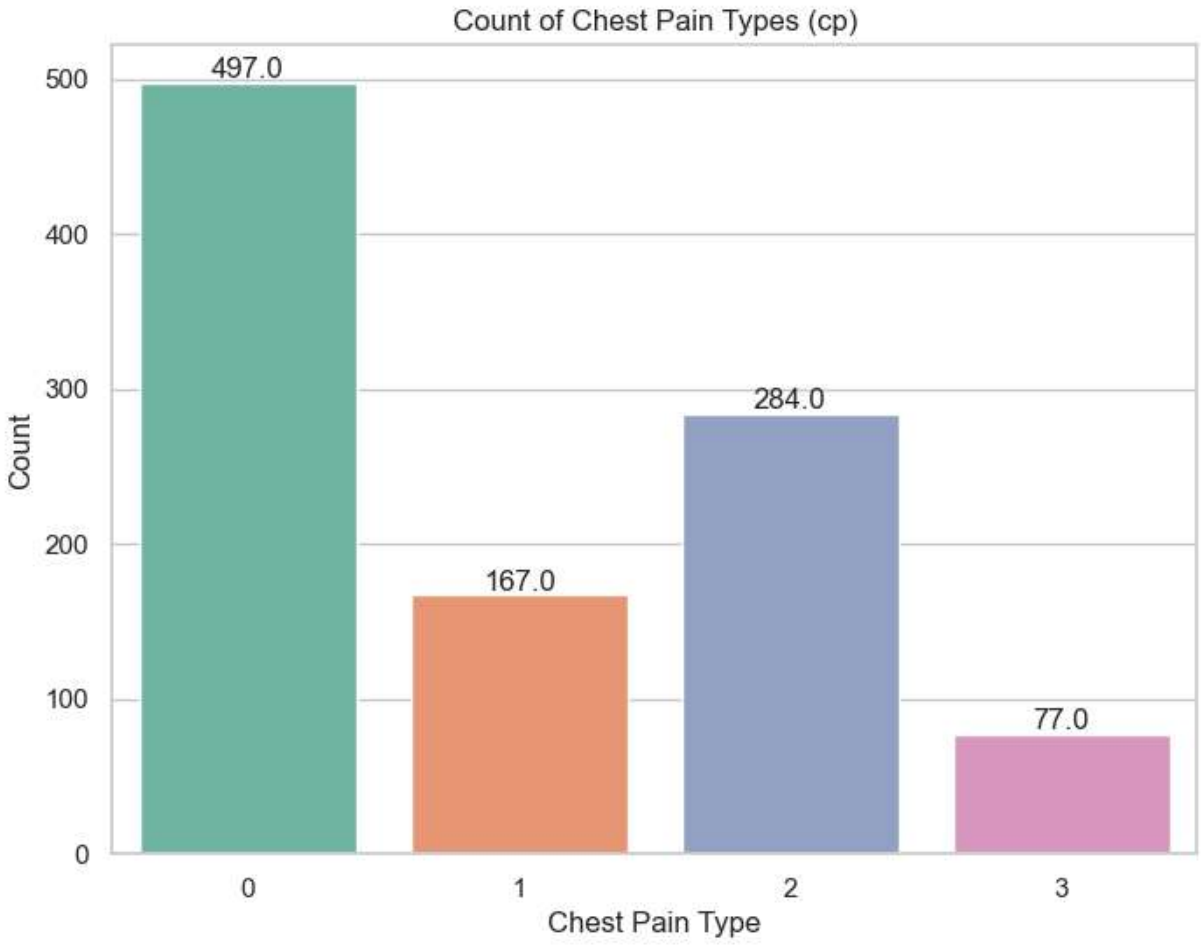
In [41]:
```
df['cp'].nunique()
```

Out[41]:
```
4
```

In [42]:
```
df['cp'].value_counts()
```

Out[42]:
```
cp
0    497
2    284
1    167
3     77
Name: count, dtype: int64
```

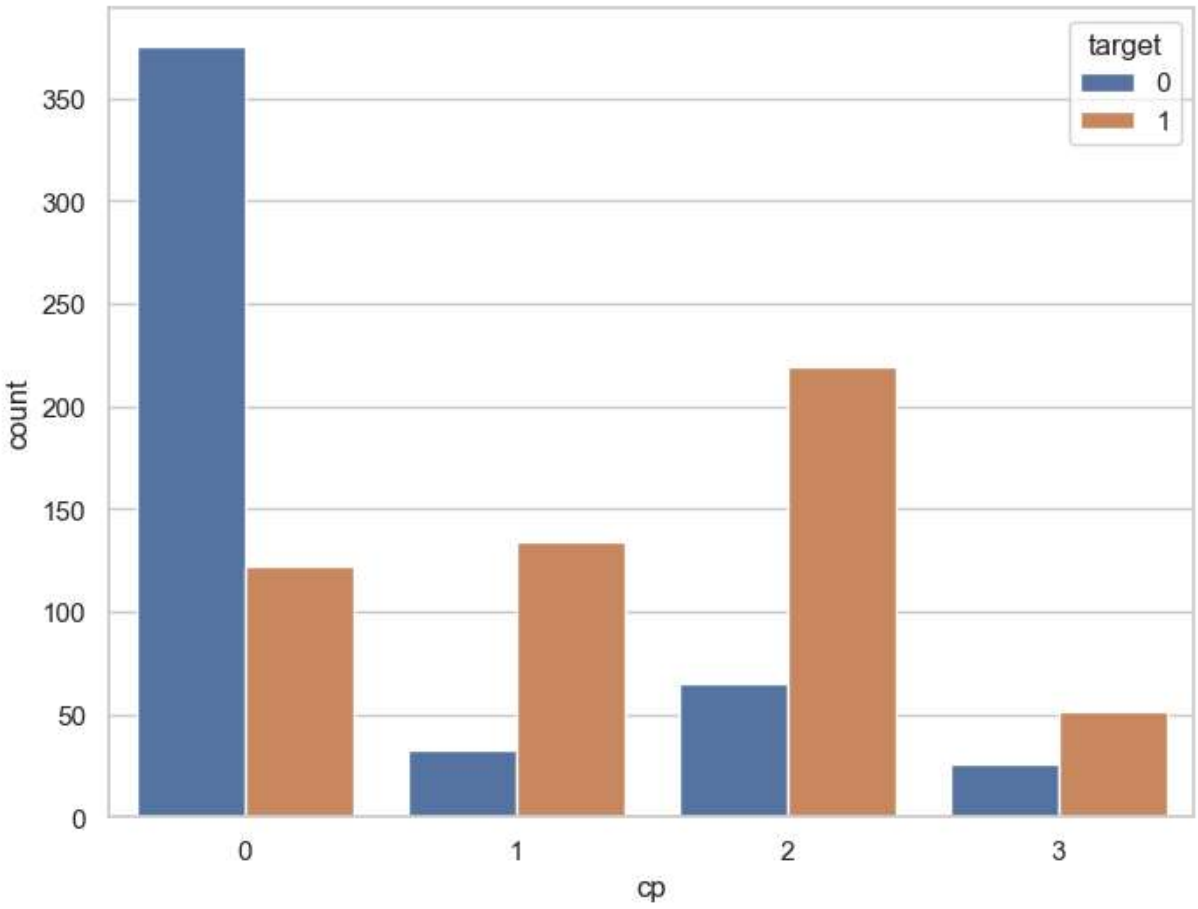
In [45]:
```
f, ax = plt.subplots(figsize=(8, 6))

# Set a color palette with as many colors as cp categories
ax = sns.countplot(x="cp", data=df, palette="Set2")  # or try 'husl', 'coolwarm', '

# Add labels and title
ax.set_title("Count of Chest Pain Types (cp)")
ax.set_xlabel("Chest Pain Type")
ax.set_ylabel("Count")

# Optional: Add value labels on bars
for p in ax.patches:
    ax.annotate(f'{p.get_height()}', (p.get_x() + p.get_width() / 2., p.get_height(
                ha='center', va='bottom')

plt.show()
```



In [46]:
```
df.groupby('cp')['target'].value_counts()
```

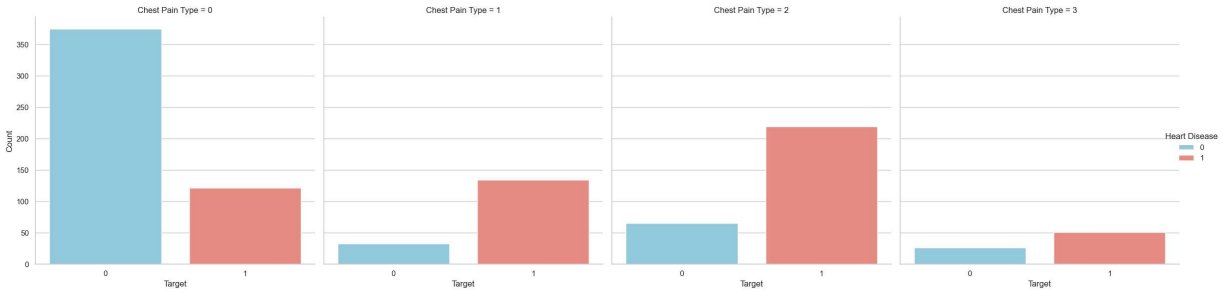
Out[46]:
```
cp  target
0   0         375
    1         122
1   1         134
    0          33
2   1         219
    0          65
3   1          51
    0          26
Name: count, dtype: int64
```

In [47]:
```
f, ax = plt.subplots(figsize=(8, 6))
ax = sns.countplot(x="cp", hue="target", data=df)
plt.show()
```



In [51]:
```
# Convert target to int if needed
df["target"] = df["target"].astype(int)

# Plot with hue and custom color palette
ax = sns.catplot(
    x="target",
    col="cp",
    data=df,
    kind="count",
    hue="target",
    palette={0: "skyblue", 1: "salmon"},
    height=6,
    aspect=1
```

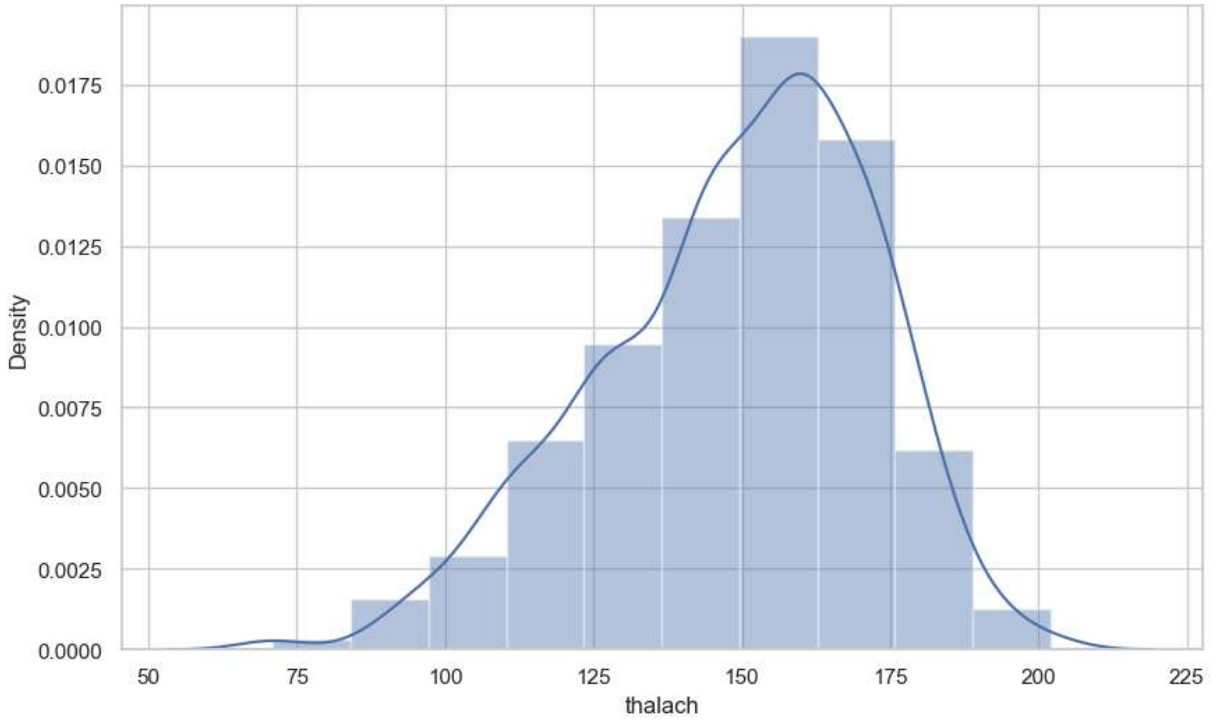
```
)

# Titles and labels
ax.set_titles("Chest Pain Type = {col_name}")
ax.set_axis_labels("Target", "Count")
ax._legend.set_title("Heart Disease")

plt.show()
```



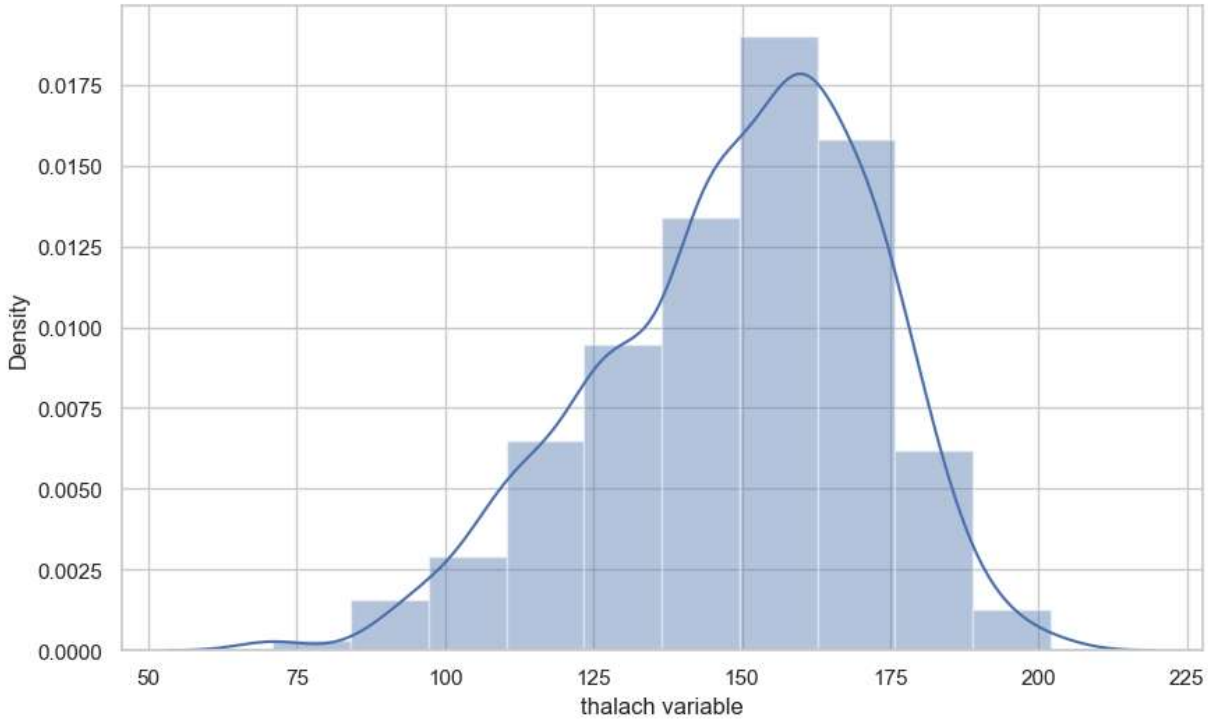
In [52]:
```
df['thalach'].nunique()
```

Out[52]: 91

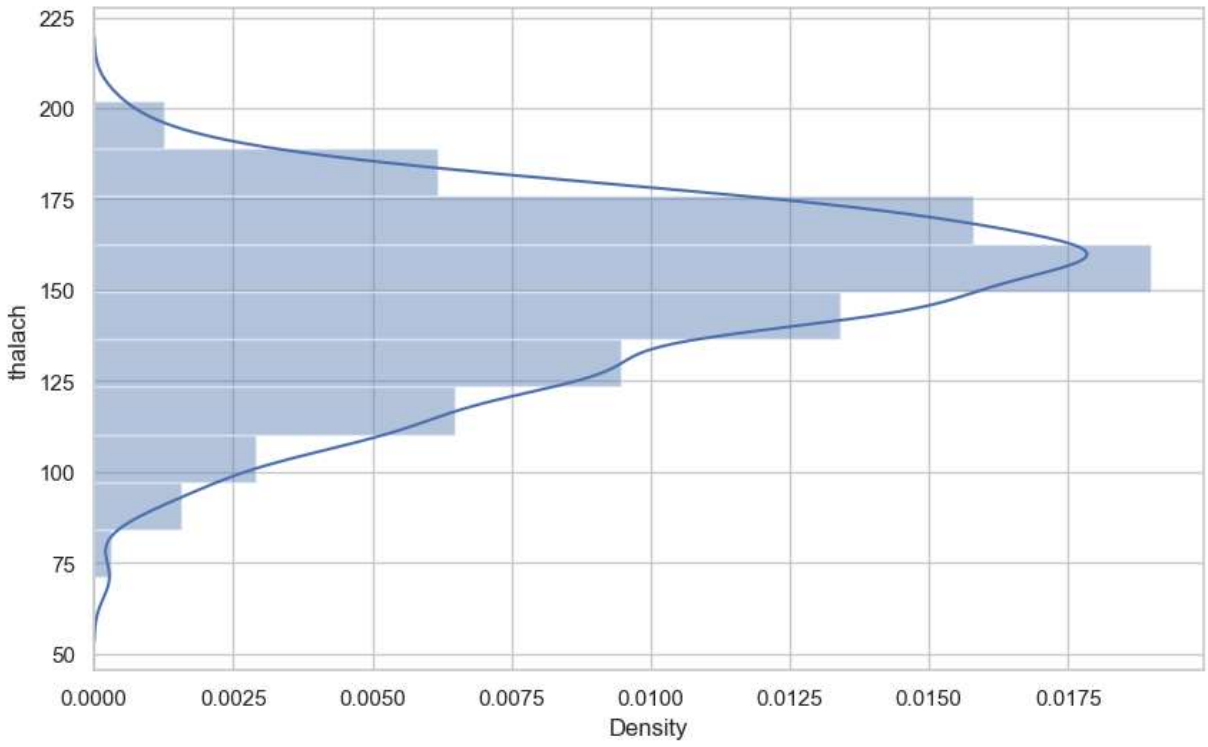
In [53]:
```
f, ax = plt.subplots(figsize=(10,6))
x = df['thalach']
ax = sns.distplot(x, bins=10)
plt.show()
```



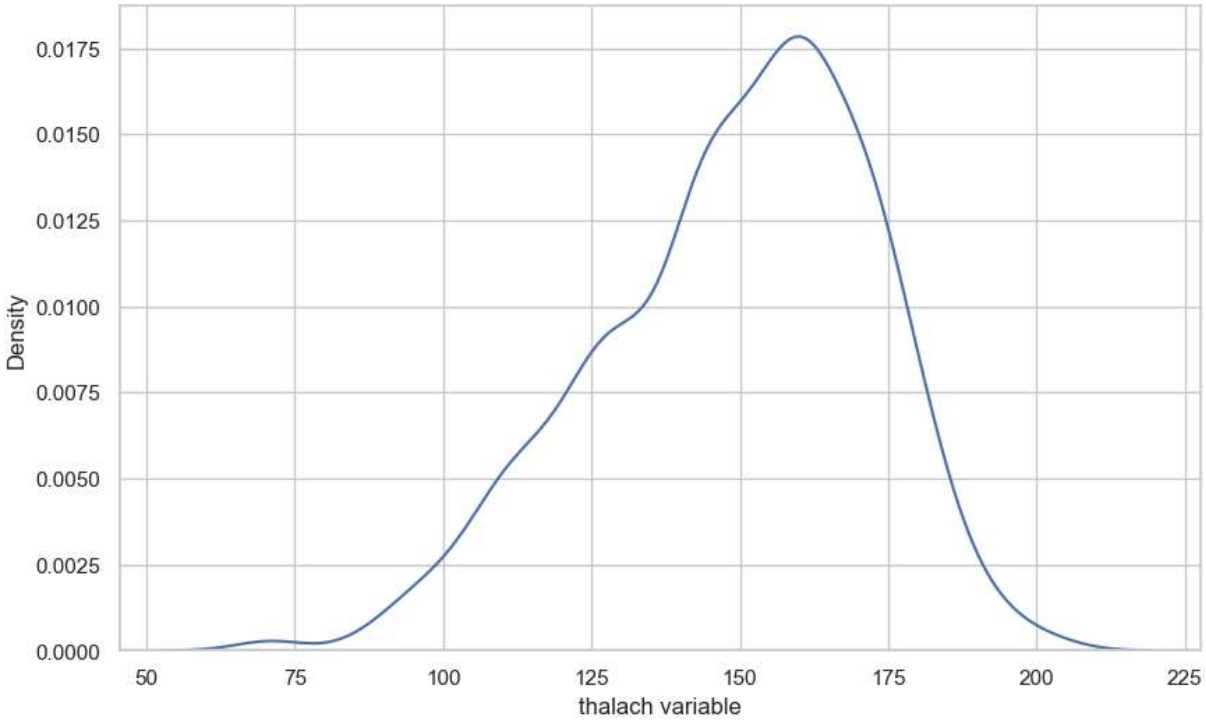
In [54]:
```
f, ax = plt.subplots(figsize=(10,6))
x = df['thalach']
x = pd.Series(x, name="thalach variable")
ax = sns.distplot(x, bins=10)
plt.show()
```



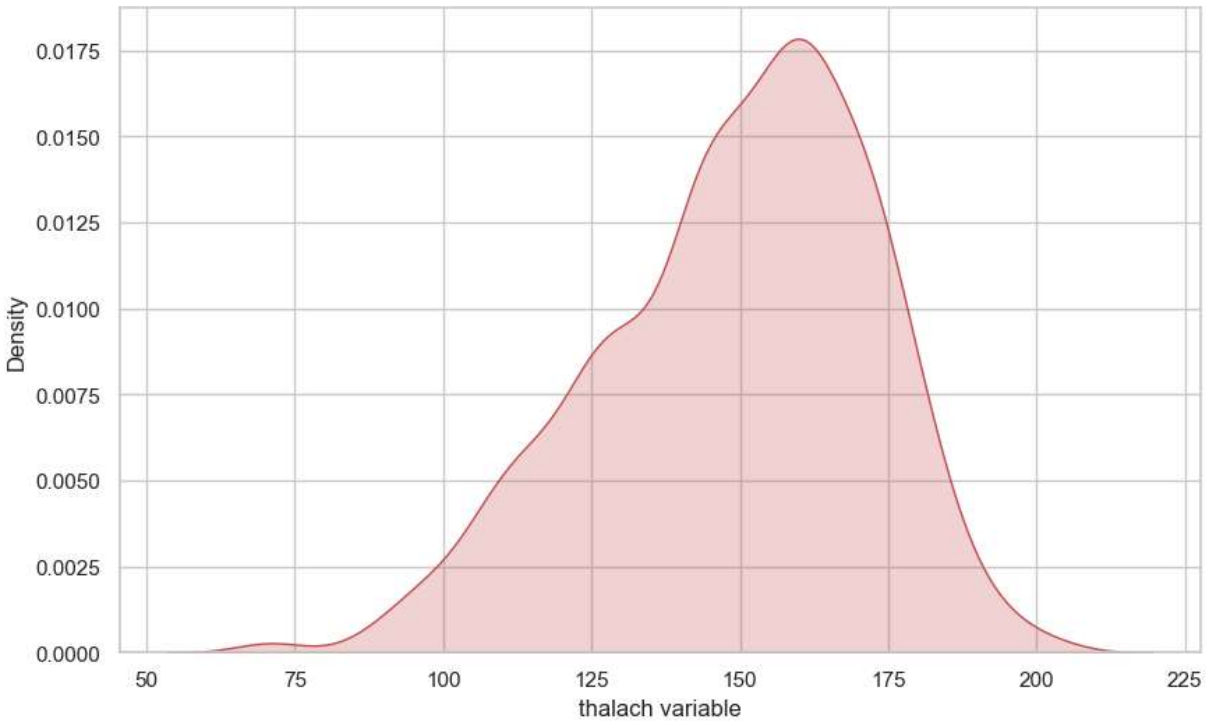
In [55]:
```
f, ax = plt.subplots(figsize=(10,6))
x = df['thalach']
ax = sns.distplot(x, bins=10, vertical=True)
plt.show()
```



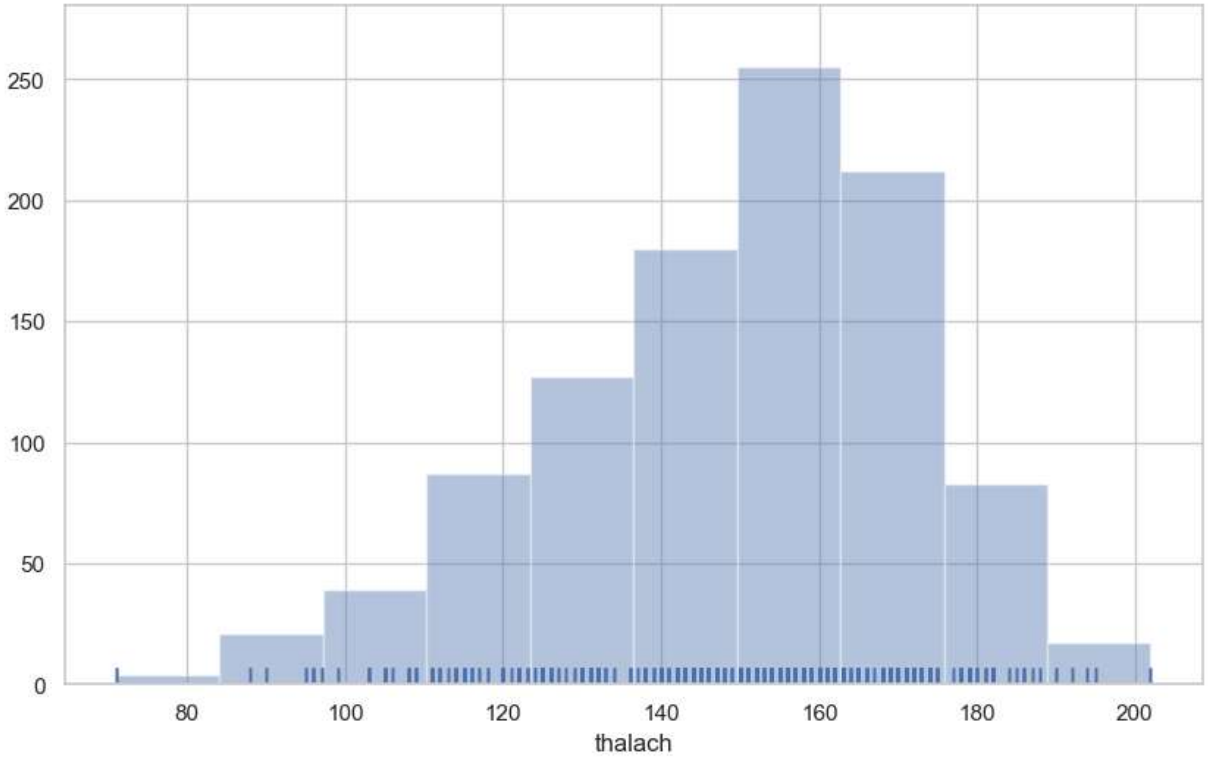
In [57]:
```
f, ax = plt.subplots(figsize=(10,6))
x = df['thalach']
x = pd.Series(x, name="thalach variable")
ax = sns.kdeplot(x)
plt.show()
```



In [58]:
```
f, ax = plt.subplots(figsize=(10,6))
x = df['thalach']
x = pd.Series(x, name="thalach variable")
ax = sns.kdeplot(x, shade=True, color='r')
plt.show()
```

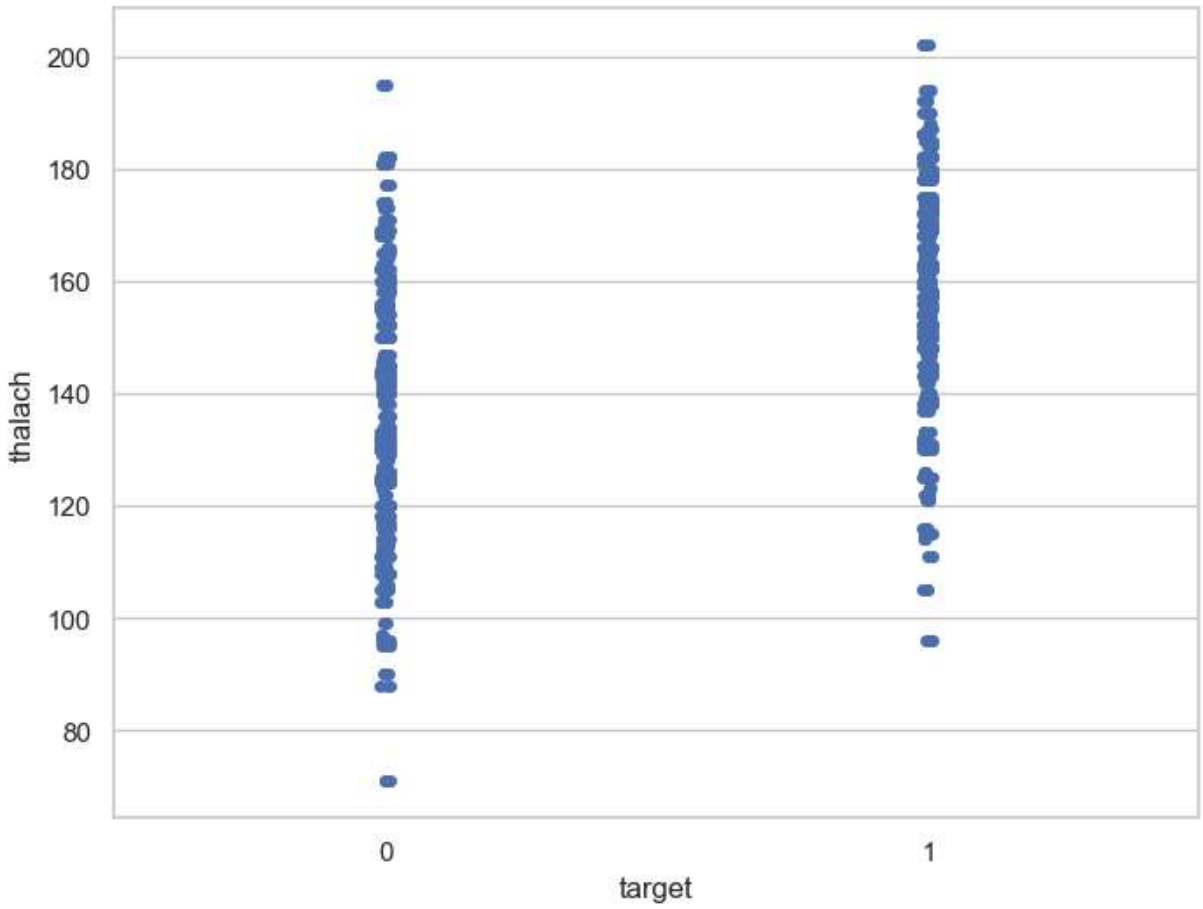


In [59]:
```
f, ax = plt.subplots(figsize=(10,6))
x = df['thalach']
ax = sns.distplot(x, kde=False, rug=True, bins=10)
plt.show()
```

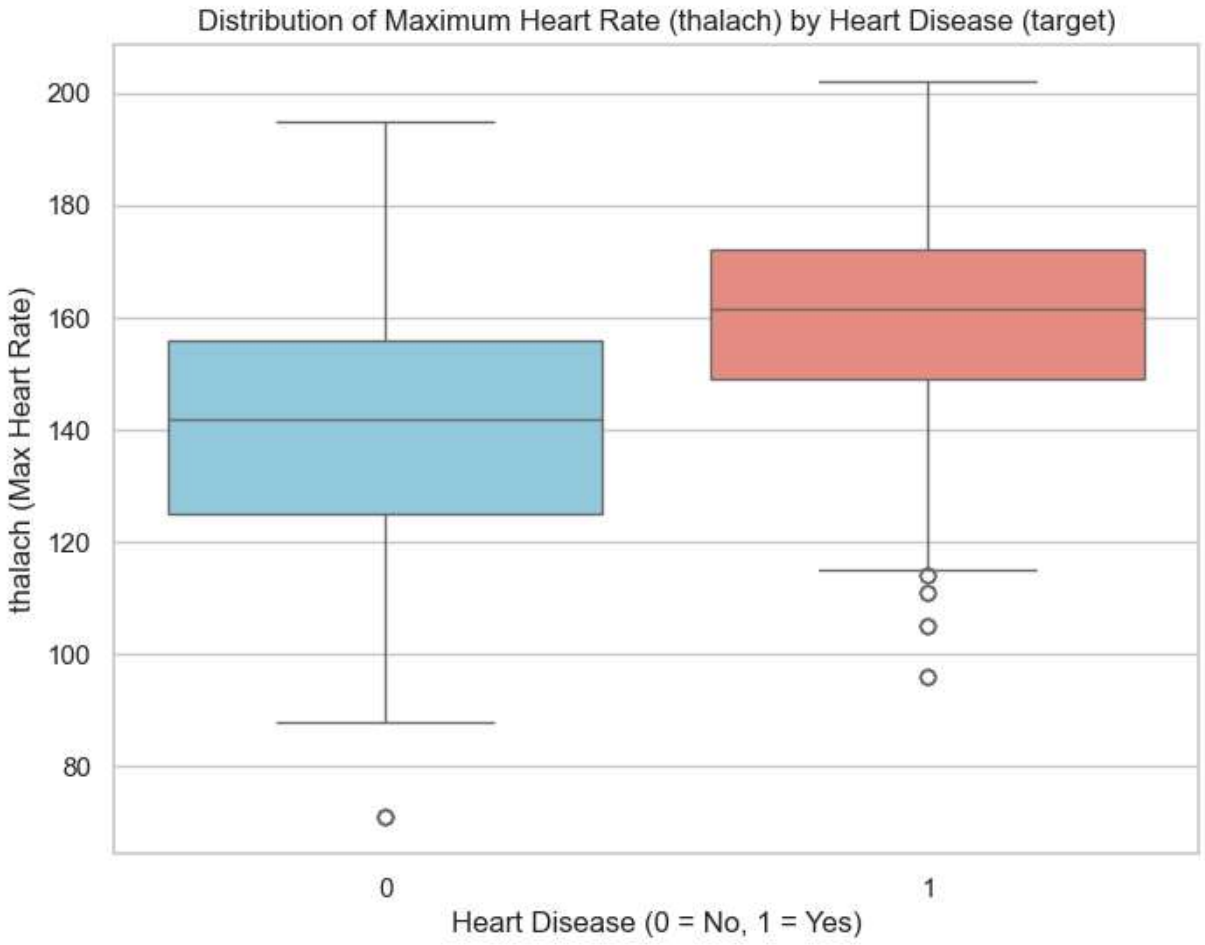


In [62]:
```python
# Convert target to int if not already
df["target"] = df["target"].astype(int)

# Stripplot with hue and jitter
f, ax = plt.subplots(figsize=(8, 6))
sns.stripplot(
    x="target",
    y="thalach",
    data=df,
    hue="target",
    jitter=0.25,
    palette={0: "skyblue", 1: "salmon"},
    dodge=True
)

# Titles and labels
plt.title("Maximum Heart Rate Achieved (thalach) by Target")
plt.xlabel("Heart Disease (0 = No, 1 = Yes)")
plt.ylabel("Maximum Heart Rate (thalach)")
plt.legend(title="Target")

plt.show()
```

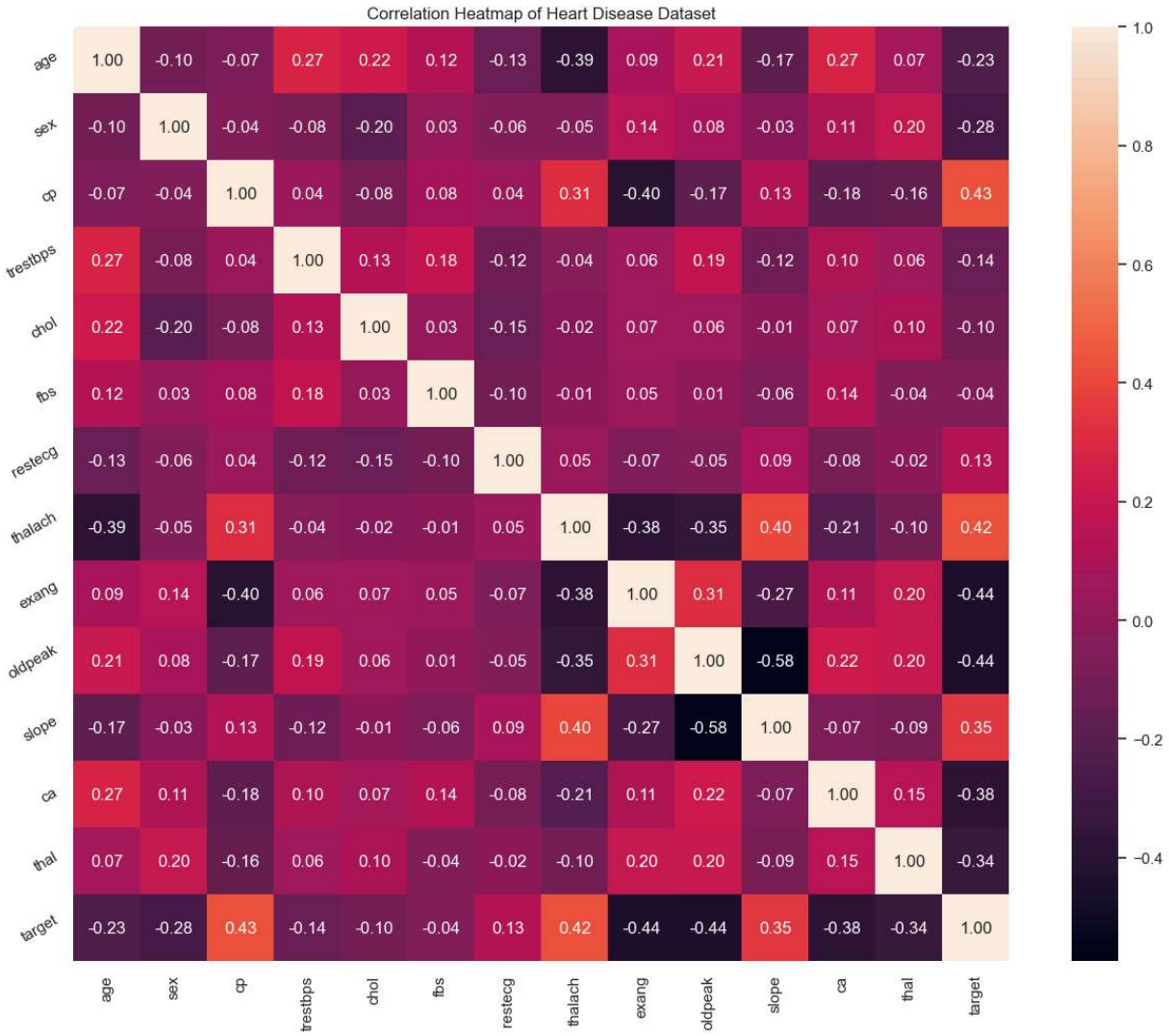
In [65]:
```
f, ax = plt.subplots(figsize=(8, 6))
sns.stripplot(x="target", y="thalach", data=df, jitter = 0.01)
plt.show()
```



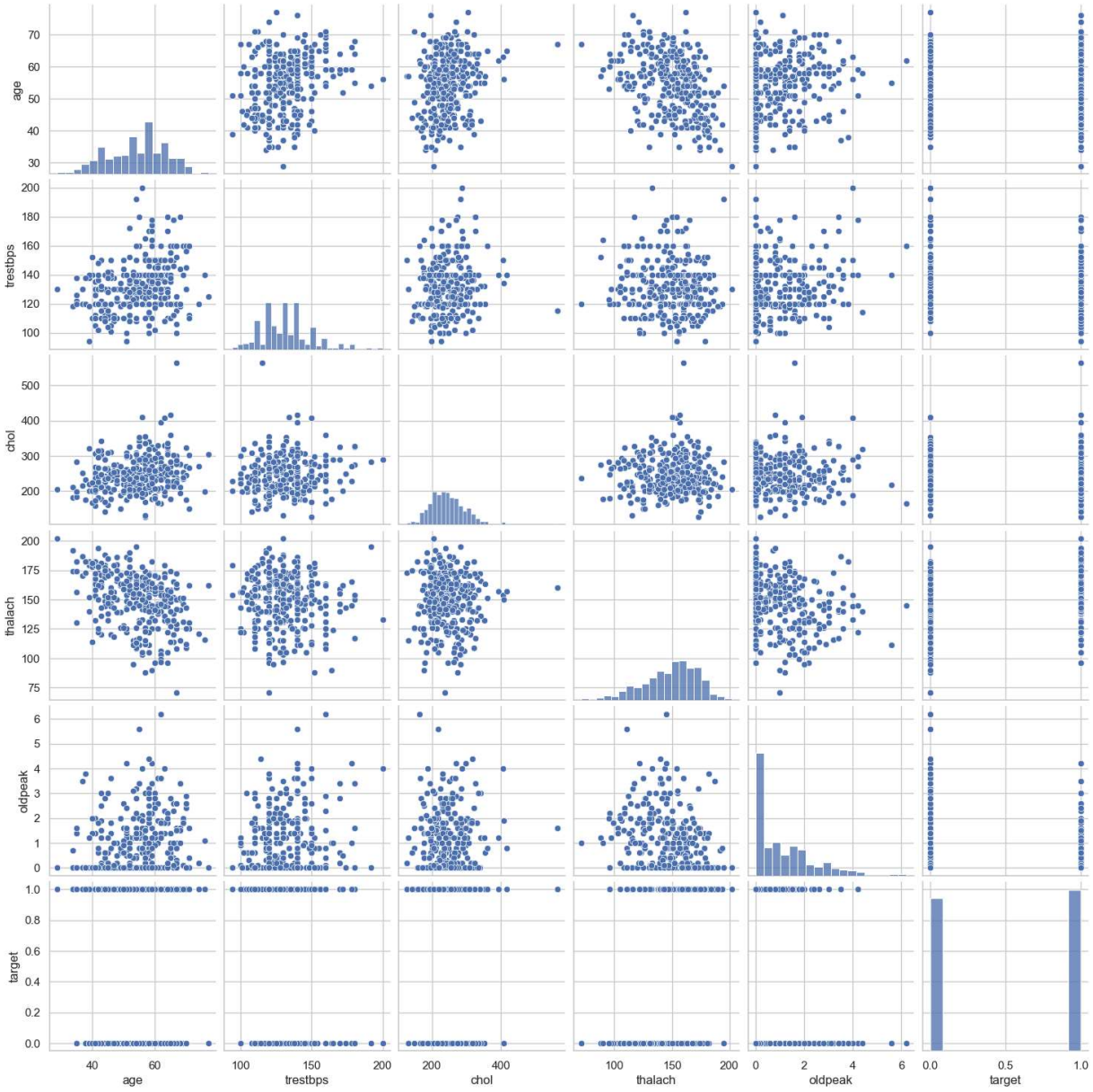
In [69]:
```
f, ax = plt.subplots(figsize=(8, 6))
sns.boxplot(
    x="target",
    y="thalach",
    data=df,
    palette={'0': "skyblue", '1': "salmon"}  # Use string keys
)
plt.title("Distribution of Maximum Heart Rate (thalach) by Heart Disease (target)")
plt.xlabel("Heart Disease (0 = No, 1 = Yes)")
plt.ylabel("thalach (Max Heart Rate)")
plt.show()
```



In [70]:
```
plt.figure(figsize=(16,12))
plt.title('Correlation Heatmap of Heart Disease Dataset')
a = sns.heatmap(correlation, square=True, annot=True, fmt='.2f', linecolor='white')
a.set_xticklabels(a.get_xticklabels(), rotation=90)
a.set_yticklabels(a.get_yticklabels(), rotation=30)
plt.show()
```



In [72]:
```
num_var = ['age', 'trestbps', 'chol', 'thalach', 'oldpeak', 'target' ]
sns.pairplot(df[num_var], kind='scatter', diag_kind='hist')
plt.show()
```



In [73]:
```
df['age'].nunique()
```

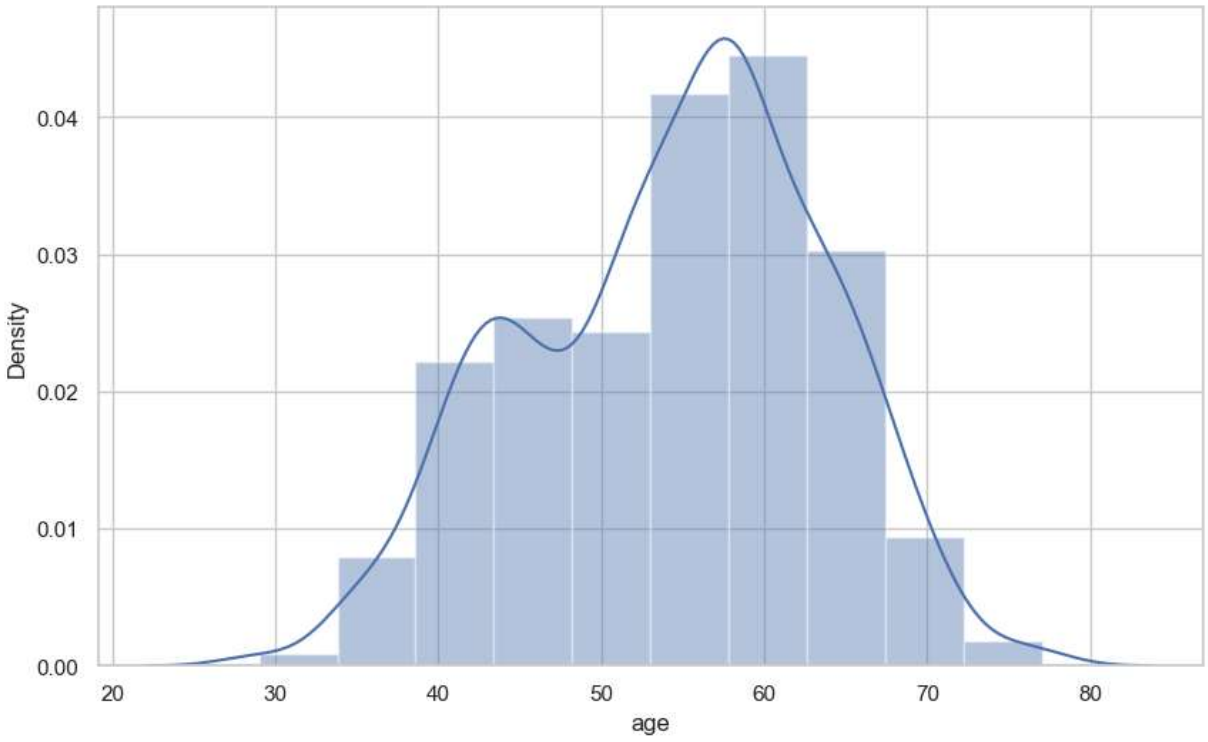
Out[73]:
```
41
```

In [74]:
```
df['age'].describe()
```

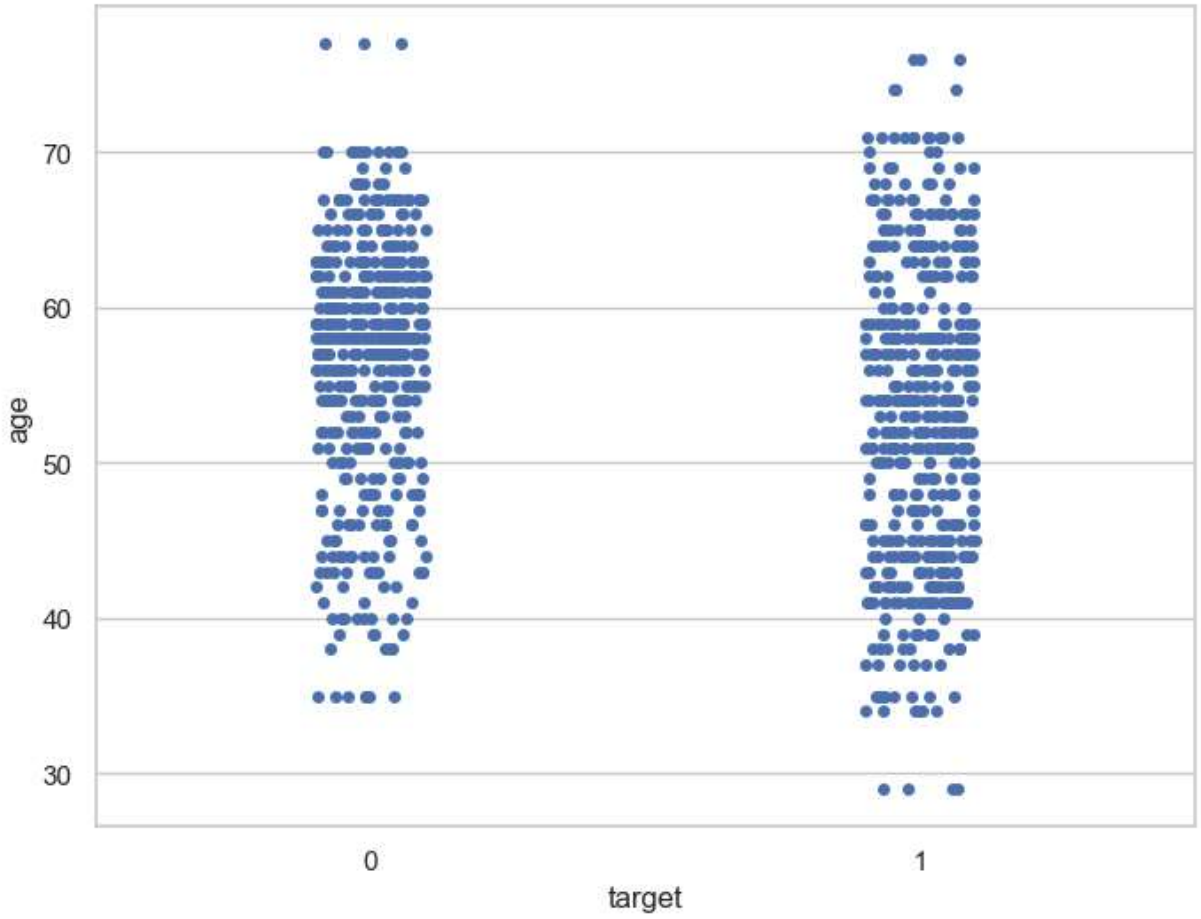
Out[74]:
```
count    1025.000000
mean       54.434146
std         9.072290
min        29.000000
25%        48.000000
50%        56.000000
75%        61.000000
max        77.000000
Name: age, dtype: float64
```

In [75]:
```
f, ax = plt.subplots(figsize=(10,6))
x = df['age']
```

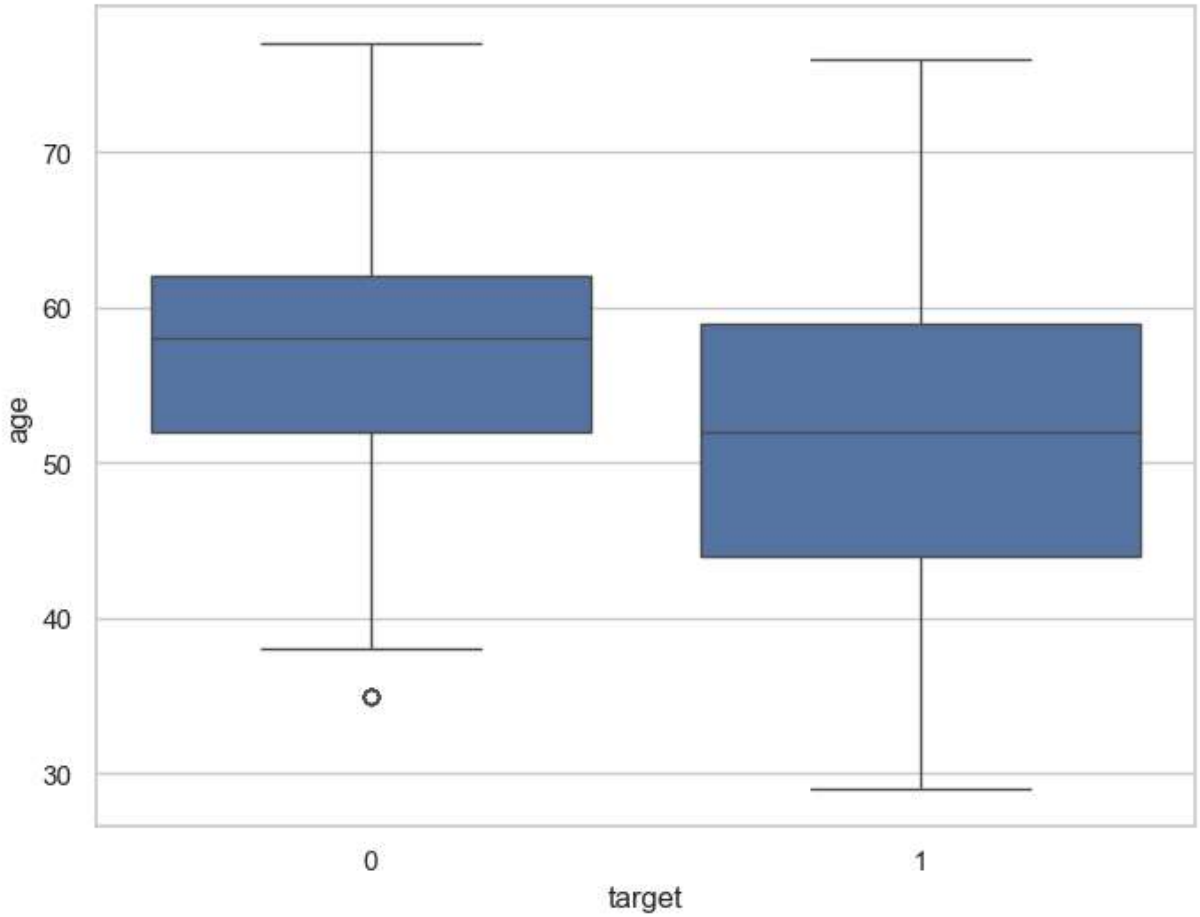
```
ax = sns.distplot(x, bins=10)
plt.show()
```



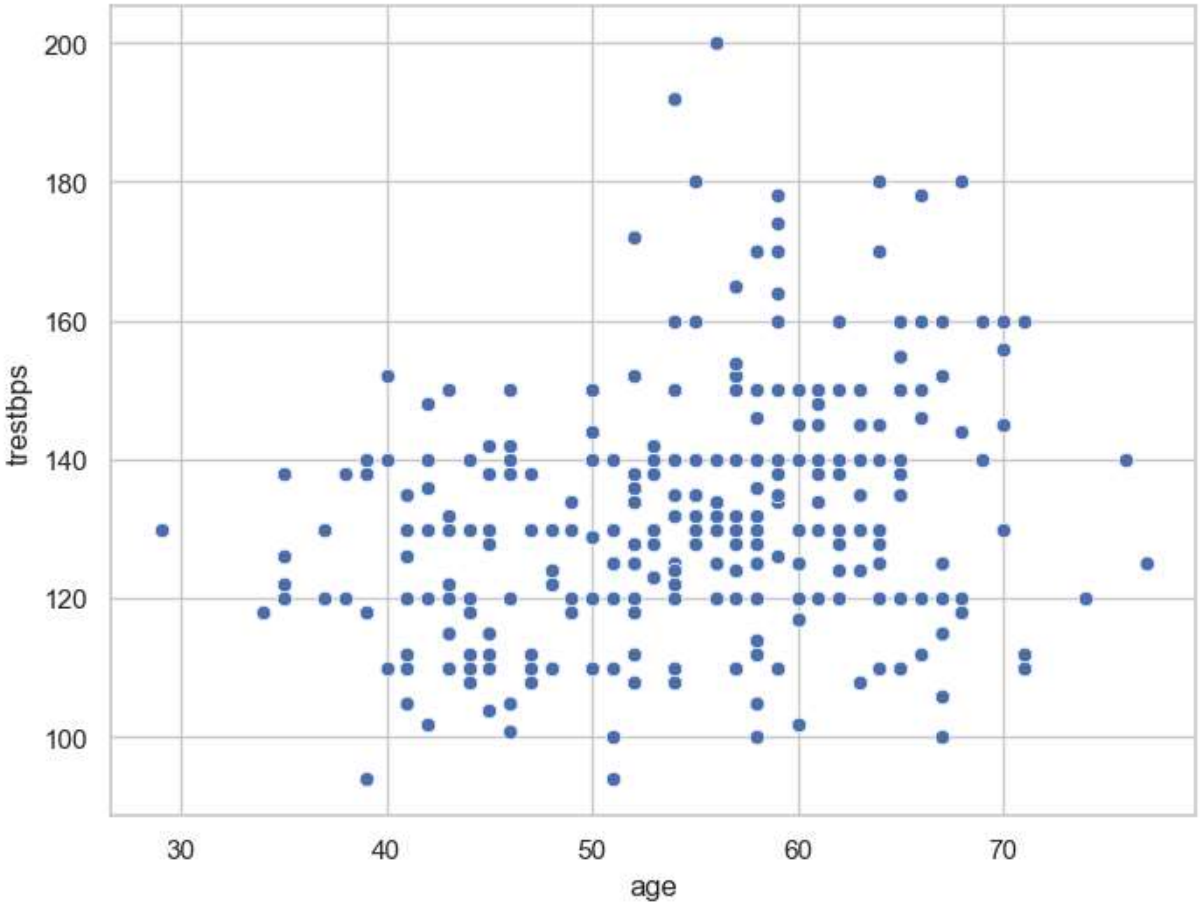
In [76]:
```
f, ax = plt.subplots(figsize=(8, 6))
sns.stripplot(x="target", y="age", data=df)
plt.show()
```



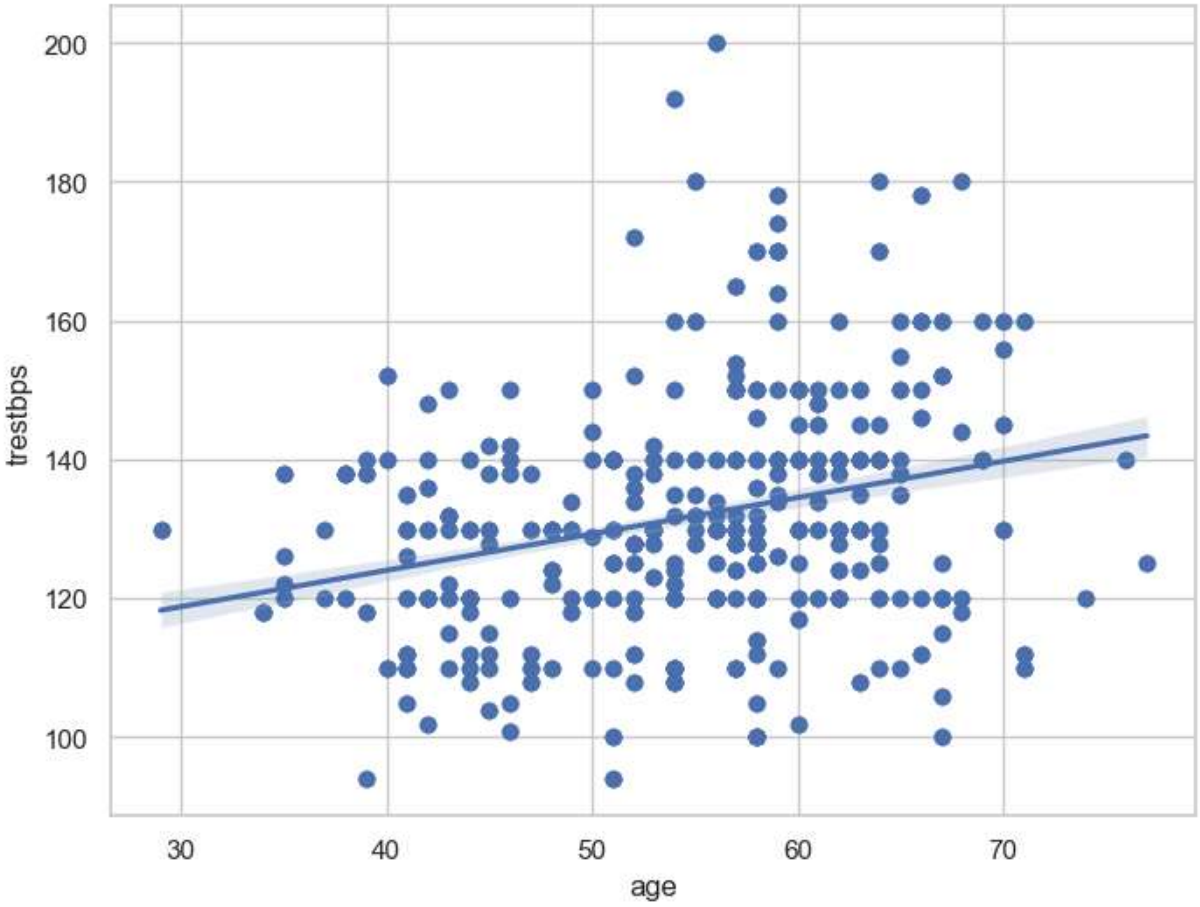
In [77]:
```
f, ax = plt.subplots(figsize=(8, 6))
sns.boxplot(x="target", y="age", data=df)
plt.show()
```



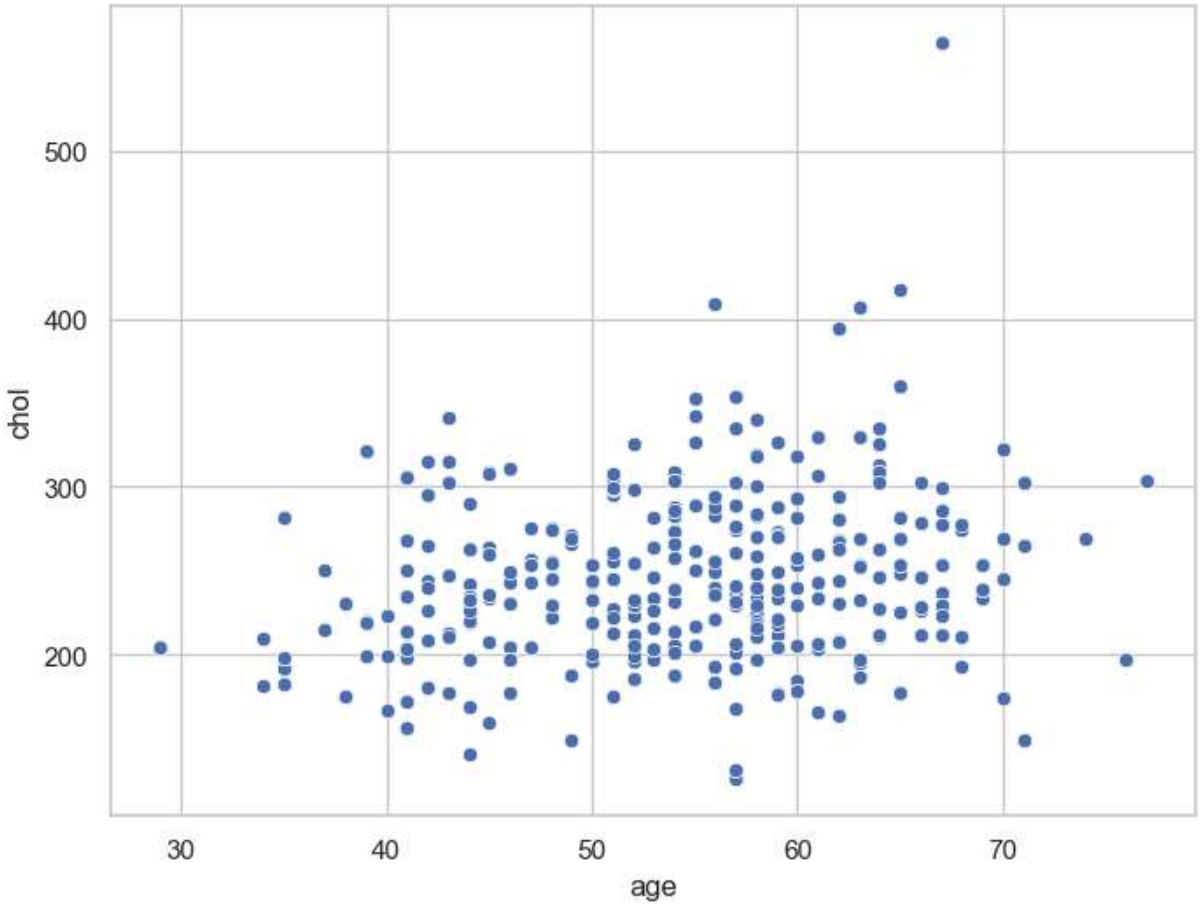
In [78]:
```
f, ax = plt.subplots(figsize=(8, 6))
ax = sns.scatterplot(x="age", y="trestbps", data=df)
plt.show()
```



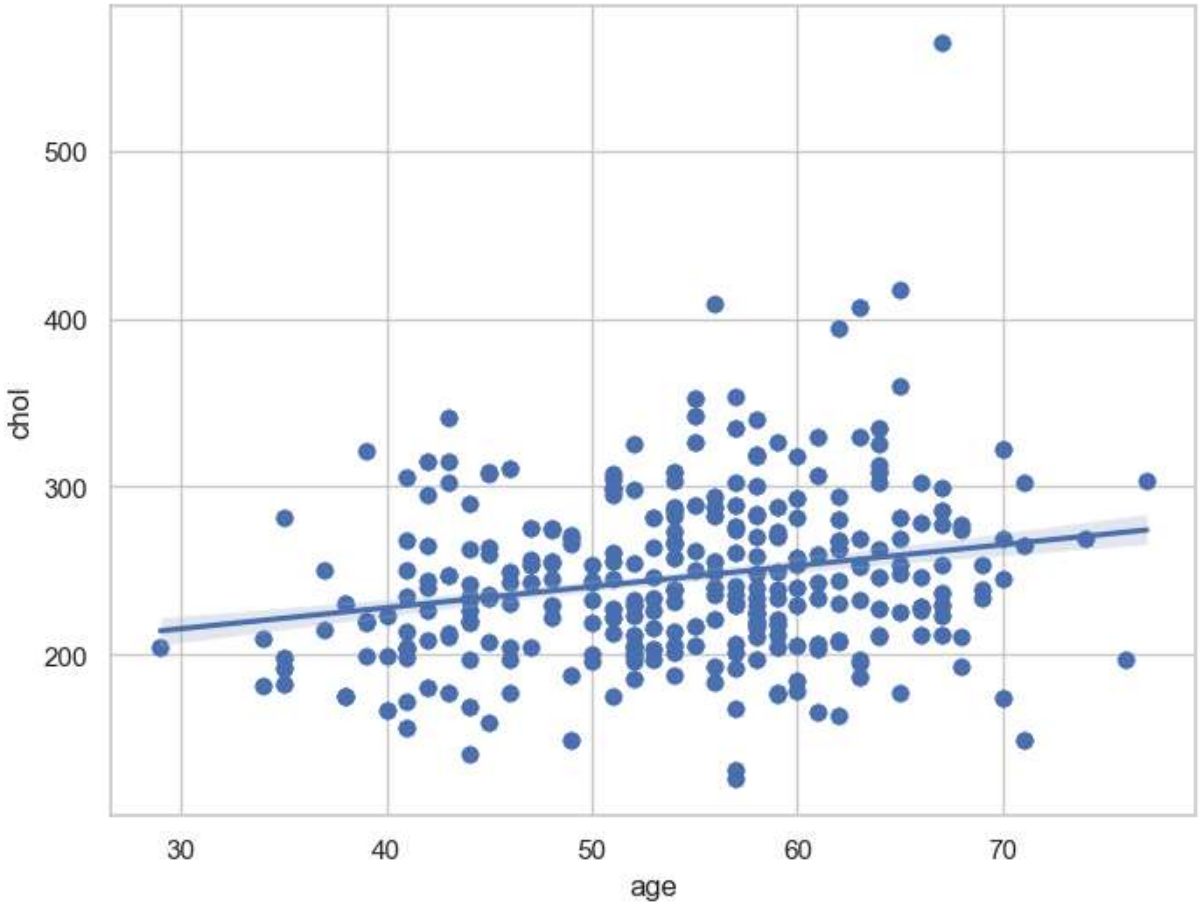
In [79]:
```
f, ax = plt.subplots(figsize=(8, 6))
ax = sns.regplot(x="age", y="trestbps", data=df)
plt.show()
```



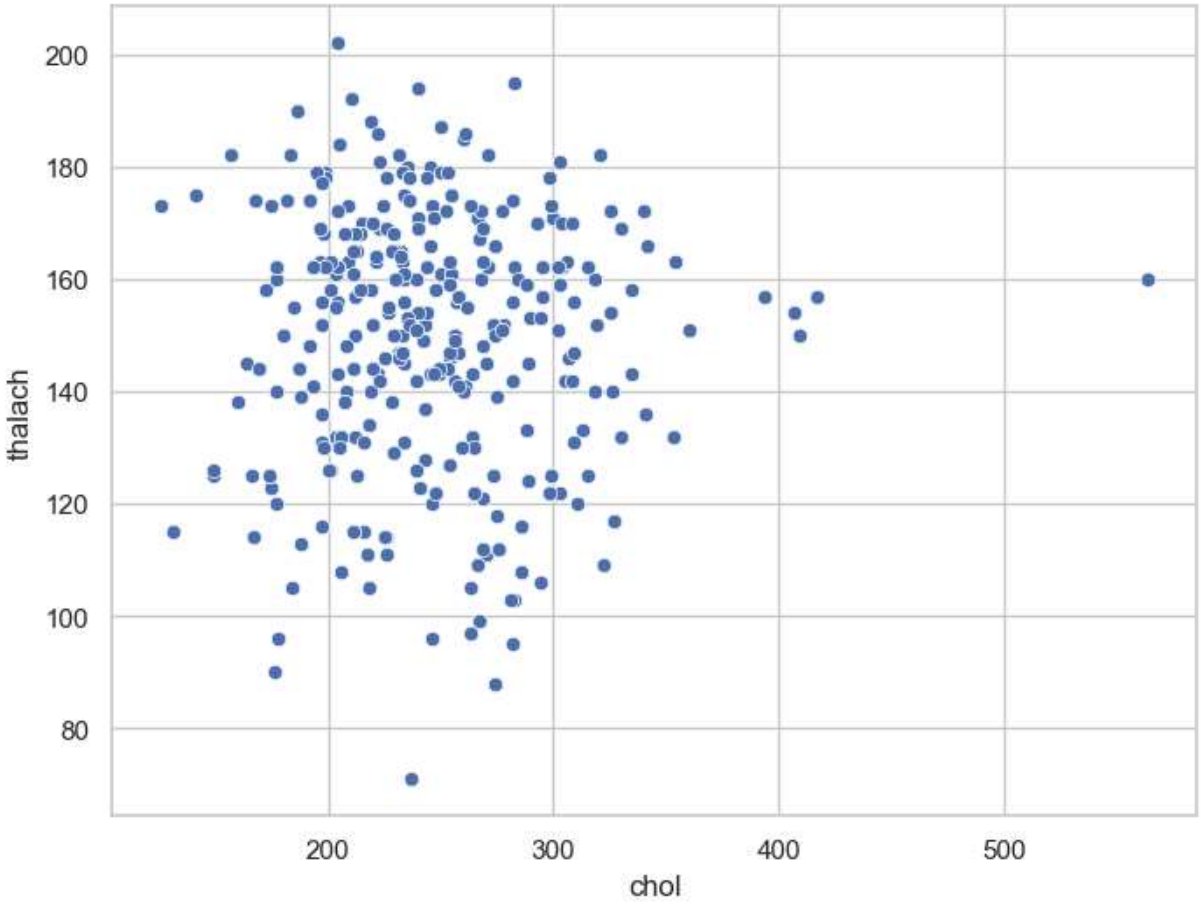
In [80]:
```
f, ax = plt.subplots(figsize=(8, 6))
ax = sns.scatterplot(x="age", y="chol", data=df)
plt.show()
```



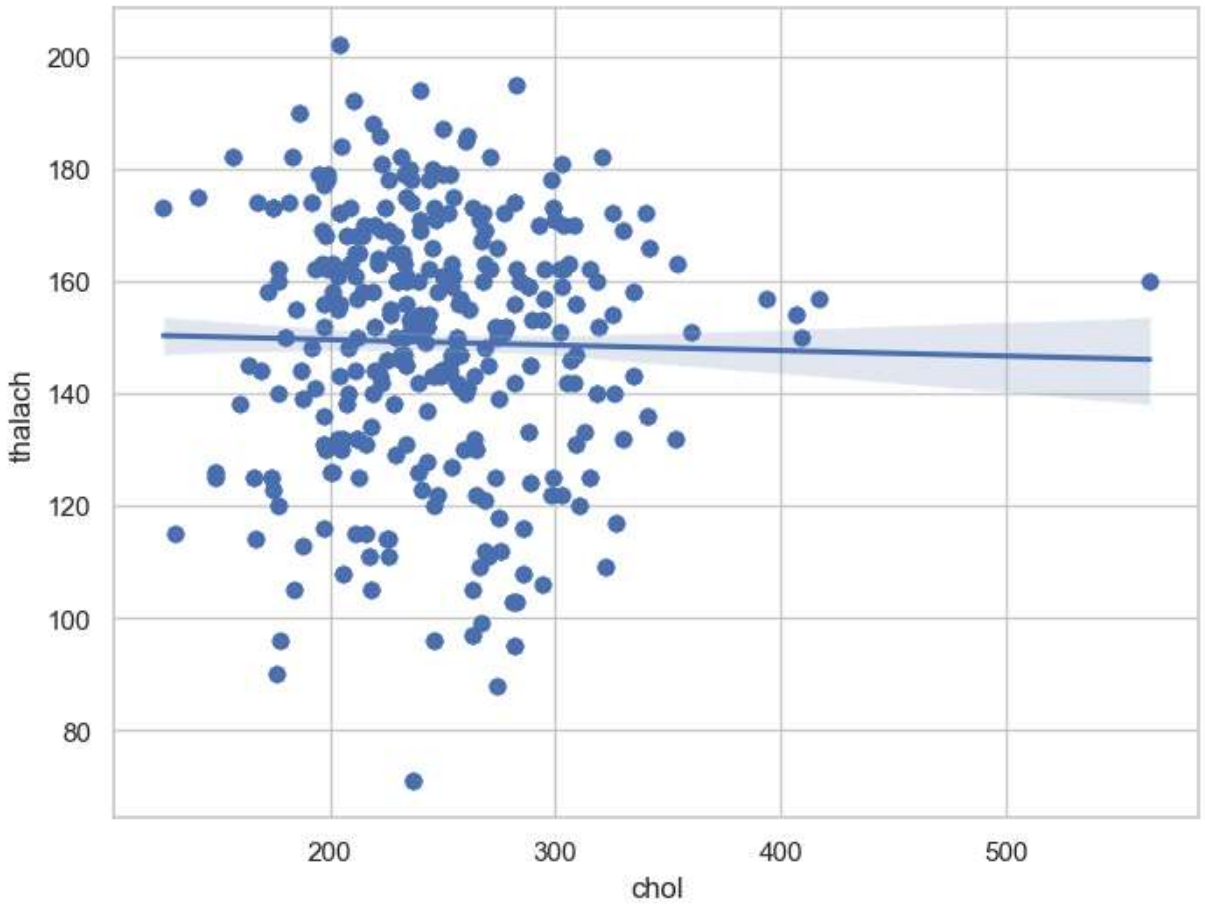
In [81]:
```
f, ax = plt.subplots(figsize=(8, 6))
ax = sns.regplot(x="age", y="chol", data=df)
plt.show()
```



In [82]:
```
f, ax = plt.subplots(figsize=(8, 6))
ax = sns.scatterplot(x="chol", y = "thalach", data=df)
plt.show()
```



In [83]:
```
f, ax = plt.subplots(figsize=(8, 6))
ax = sns.regplot(x="chol", y="thalach", data=df)
plt.show()
```



In [84]:
```
# check for missing values

df.isnull().sum()
```

Out[84]:
```
age         0
sex         0
cp          0
trestbps    0
chol        0
fbs         0
restecg     0
thalach     0
exang       0
oldpeak     0
slope       0
ca          0
thal        0
target      0
dtype: int64
```

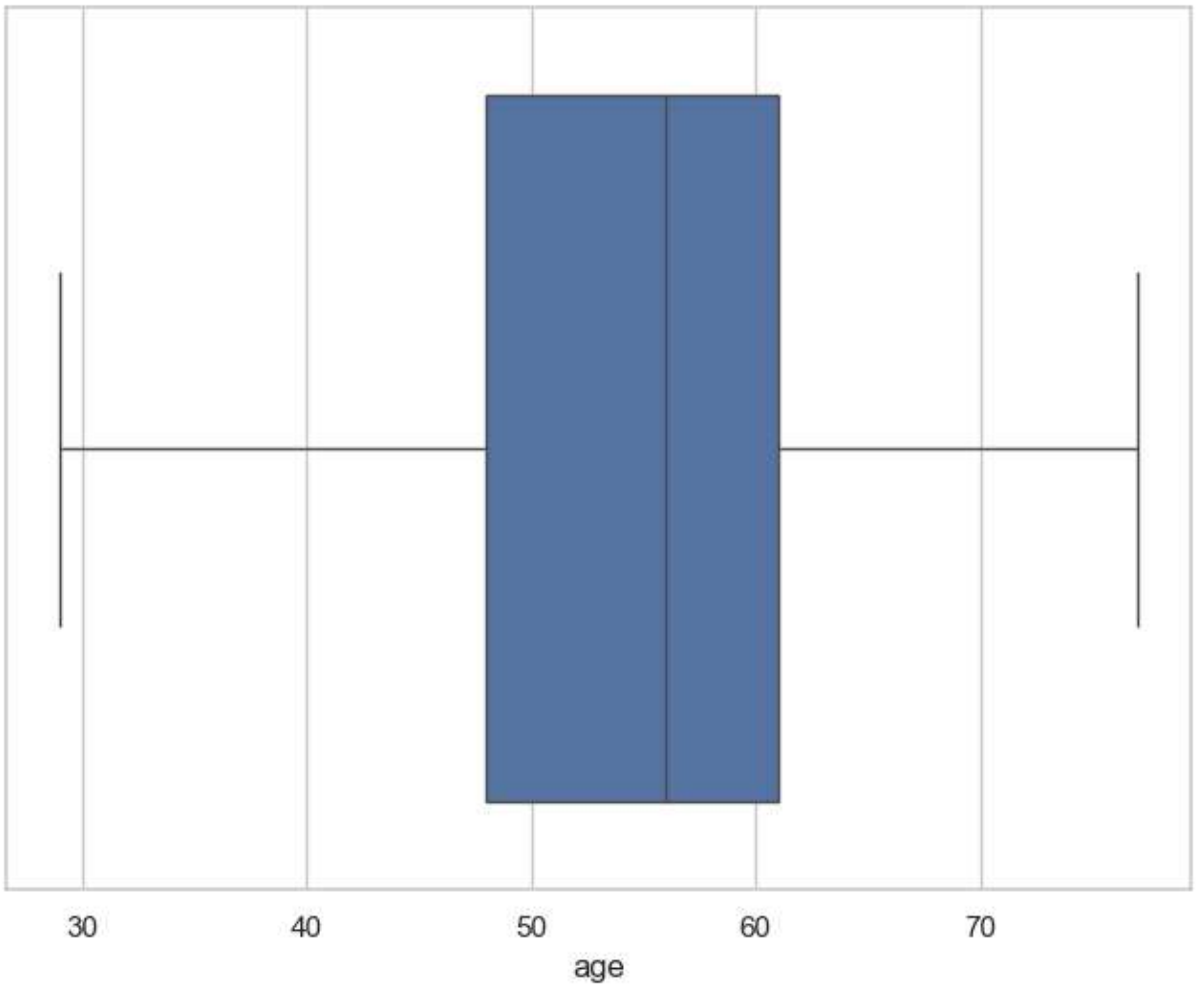
In [85]:
```
#assert that there are no missing values in the dataframe

assert pd.notnull(df).all().all()
```

In [86]:
```
#assert all values are greater than or equal to 0

assert (df >= 0).all().all()
```

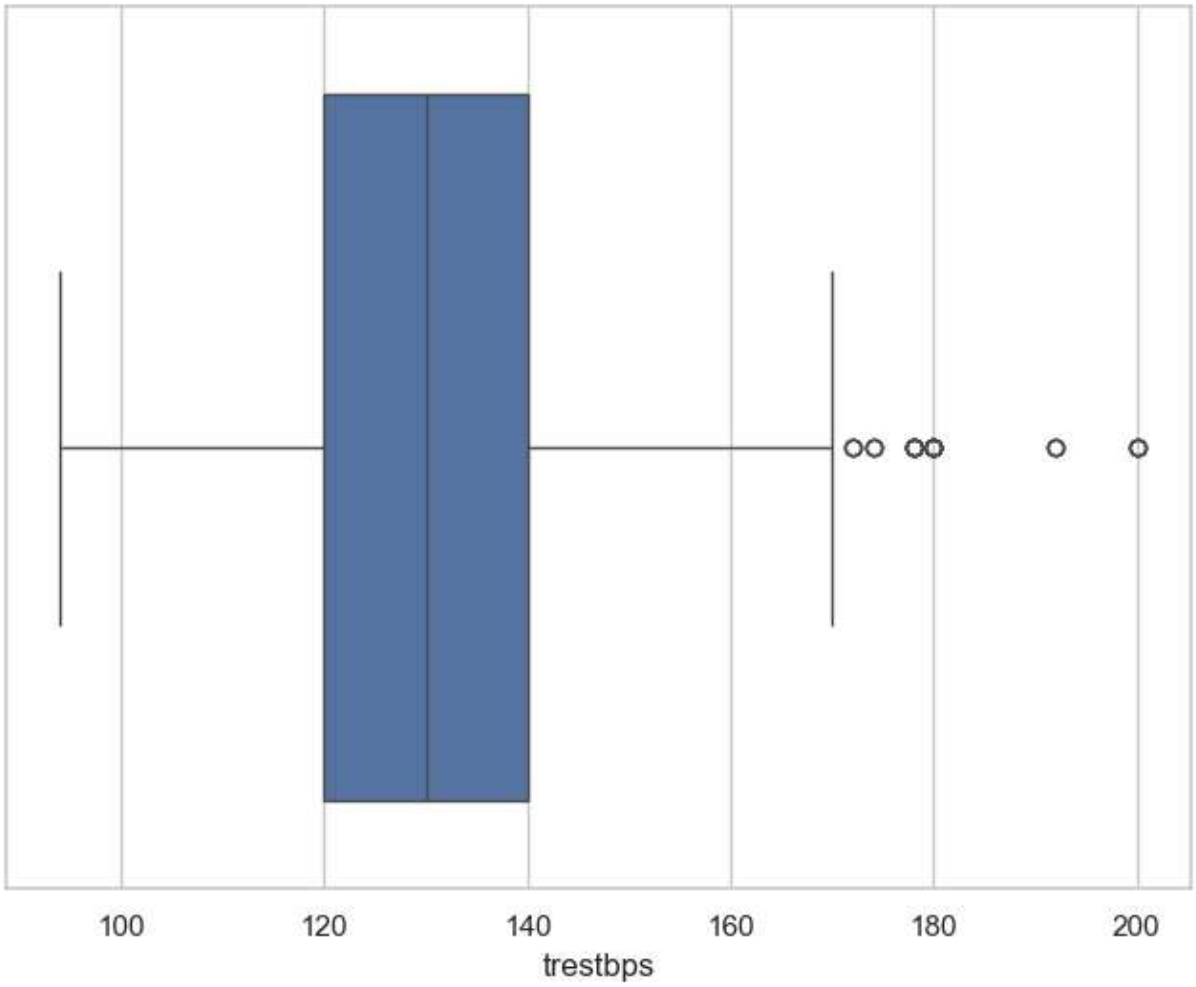
In [87]:
```
df['age'].describe()
```

Out[87]:
```
count    1025.000000
mean       54.434146
std         9.072290
min        29.000000
25%        48.000000
50%        56.000000
75%        61.000000
max        77.000000
Name: age, dtype: float64
```

In [88]:
```
f, ax = plt.subplots(figsize=(8, 6))
sns.boxplot(x=df["age"])
plt.show()
```



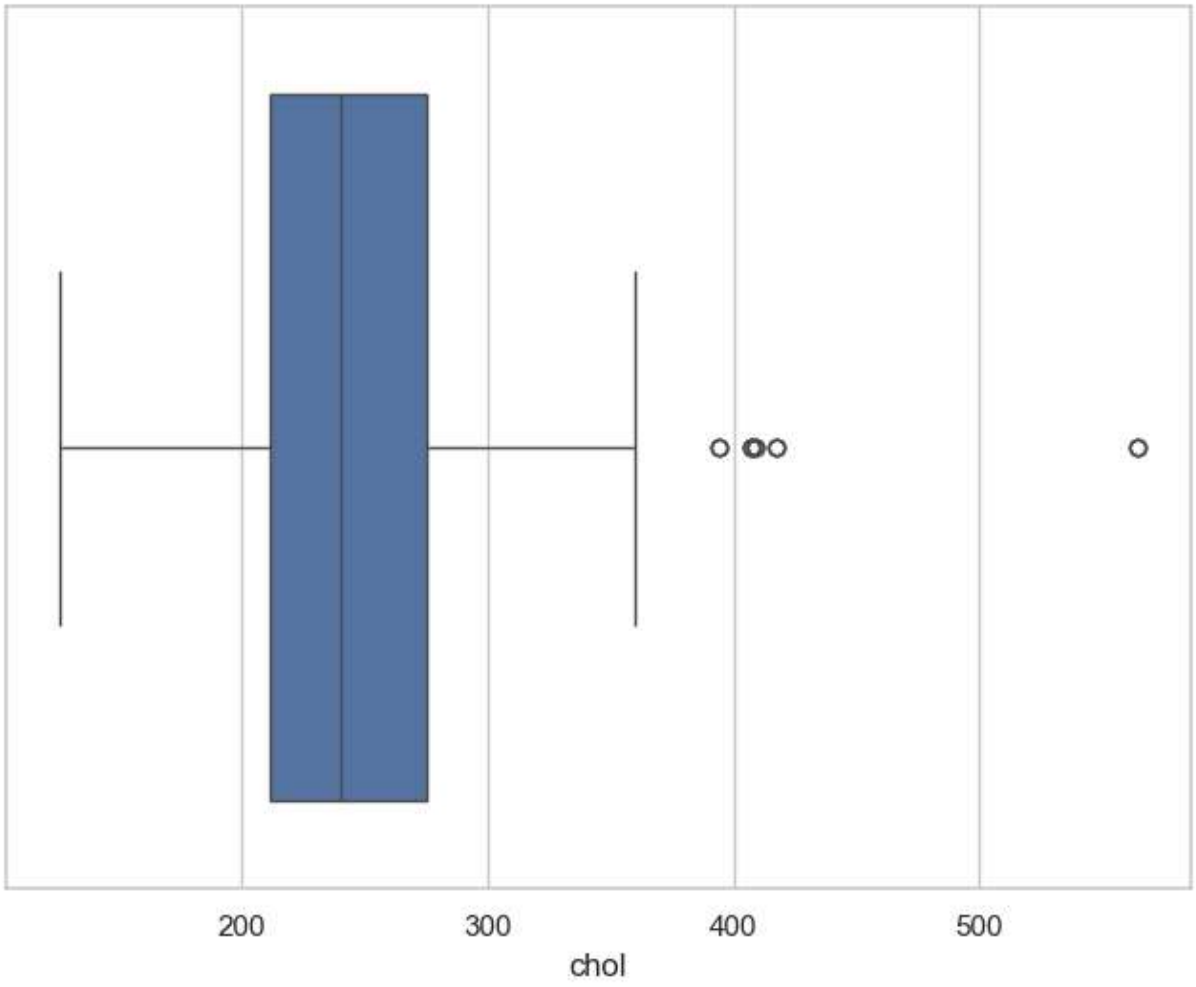
In [89]:
```
f, ax = plt.subplots(figsize=(8, 6))
sns.boxplot(x=df["trestbps"])
plt.show()
```



In [90]:
```
df['chol'].describe()
```

Out[90]:
```
count    1025.00000
mean      246.00000
std        51.59251
min       126.00000
25%       211.00000
50%       240.00000
75%       275.00000
max       564.00000
Name: chol, dtype: float64
```

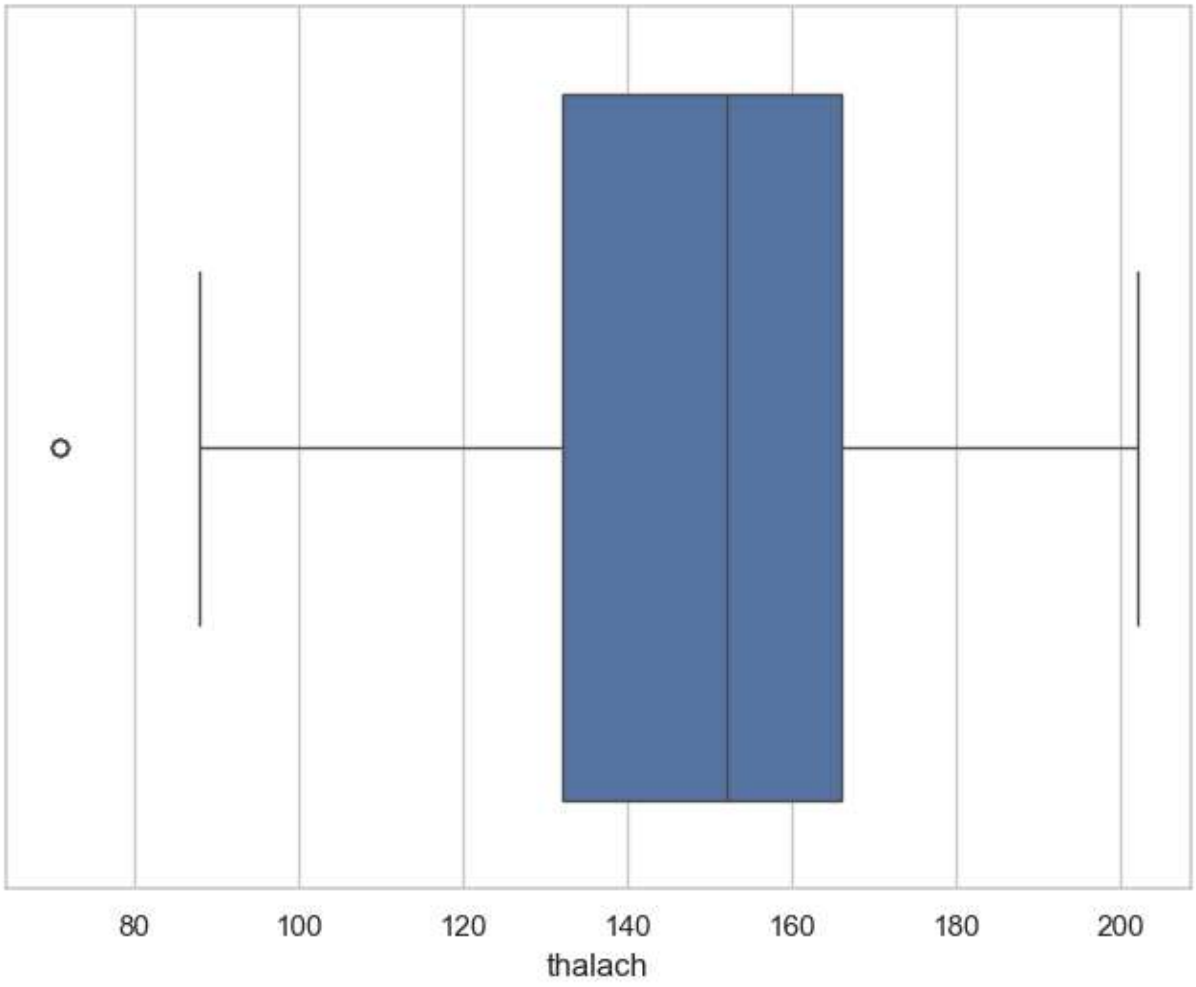
In [91]:
```
f, ax = plt.subplots(figsize=(8, 6))
sns.boxplot(x=df["chol"])
plt.show()
```



In [92]:
```
df['thalach'].describe()
```

Out[92]:
```
count    1025.000000
mean      149.114146
std        23.005724
min        71.000000
25%       132.000000
50%       152.000000
75%       166.000000
max       202.000000
Name: thalach, dtype: float64
```

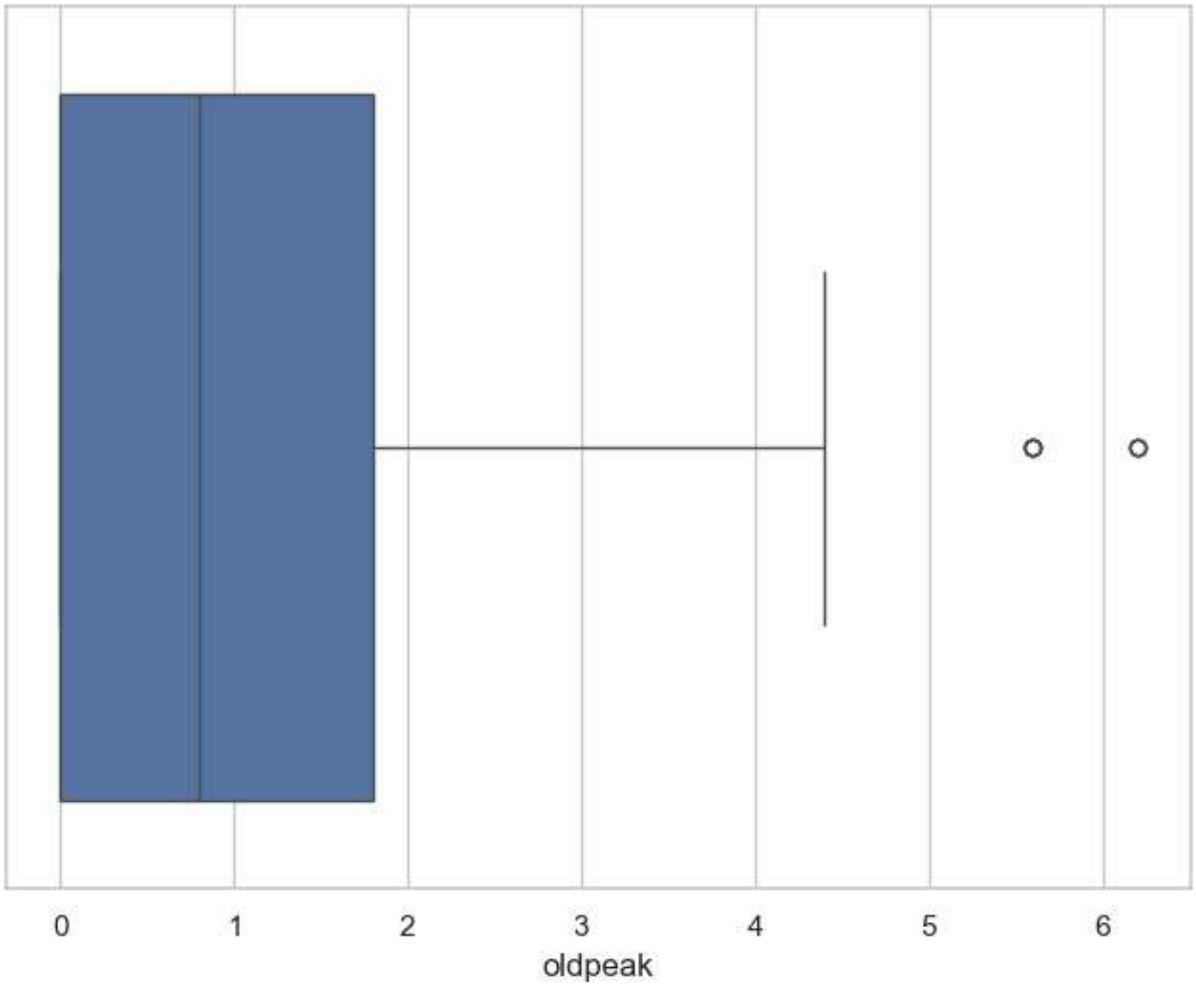
In [93]:
```
f, ax = plt.subplots(figsize=(8, 6))
sns.boxplot(x=df["thalach"])
plt.show()
```



In [94]:
```
df['oldpeak'].describe()
```

Out[94]:
```
count    1025.000000
mean        1.071512
std         1.175053
min         0.000000
25%         0.000000
50%         0.800000
75%         1.800000
max         6.200000
Name: oldpeak, dtype: float64
```

In [95]:
```
f, ax = plt.subplots(figsize=(8, 6))
sns.boxplot(x=df["oldpeak"])
plt.show()
```



In [ ]: