Data Collection

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1 Audience Retention

1.1 Function

1.1.1 2020

Retrieving audience retention data of videos from subtopic 2.1 Fungsi. The data was retrieved on 6 January 2024.

```
# A tibble: 400 x 4
   vid_id      elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                    <dbl>                <dbl>                     <dbl>
 1 7g35w-sL_JA               0.01                0.991                     0.696
 2 7g35w-sL_JA               0.02                0.894                     0.817
 3 7g35w-sL_JA               0.03                0.832                     0.905
 4 7g35w-sL_JA               0.04                0.858                     0.940
 5 7g35w-sL_JA               0.05                0.832                     0.949
 6 7g35w-sL_JA               0.06                0.858                     0.950
 7 7g35w-sL_JA               0.07                0.823                     0.950
 8 7g35w-sL_JA               0.08                0.832                     0.950
 9 7g35w-sL_JA               0.09                0.796                     0.950
10 7g35w-sL_JA               0.1                 0.832                     0.950
# i 390 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 2.2 Grafik Fungsi. The data was retrieved on 7 January 2024.

```
# A tibble: 600 x 4
   vid_id      elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                    <dbl>                <dbl>                     <dbl>
 1 aHo1kbccgLM               0.01                1                         0.690
 2 aHo1kbccgLM               0.02                0.9                       0.807
 3 aHo1kbccgLM               0.03                0.8                       0.894
 4 aHo1kbccgLM               0.04                0.854                     0.927
 5 aHo1kbccgLM               0.05                0.836                     0.937
```

```
 6 aHo1kbccgLM              0.06              0.864              0.940
 7 aHo1kbccgLM              0.07              0.818              0.942
 8 aHo1kbccgLM              0.08              0.782              0.944
 9 aHo1kbccgLM              0.09              0.773              0.946
10 aHo1kbccgLM              0.1               0.754              0.948
# i 590 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 2.3 Informasi Penting Grafik Fungsi. The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=elapsedVideoTimeRatio&en
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 400 x 4
   vid_id        elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                      <dbl>                <dbl>                     <dbl>
 1 MD5LDDmH3Lo                 0.01                 1.01                     0.770
 2 MD5LDDmH3Lo                 0.02                 0.840                    0.862
 3 MD5LDDmH3Lo                 0.03                 0.774                    0.922
 4 MD5LDDmH3Lo                 0.04                 0.755                    0.939
 5 MD5LDDmH3Lo                 0.05                 0.802                    0.943
 6 MD5LDDmH3Lo                 0.06                 0.783                    0.945
 7 MD5LDDmH3Lo                 0.07                 0.764                    0.948
 8 MD5LDDmH3Lo                 0.08                 0.755                    0.949
 9 MD5LDDmH3Lo                 0.09                 0.736                    0.950
10 MD5LDDmH3Lo                 0.1                  0.708                    0.950
# i 390 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 2.4 Fungsi Linear dan Model-nya. The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 300 x 4
   vid_id        elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                      <dbl>                <dbl>                     <dbl>
```

```
 1 LIkQgdMtovQ                0.01            0.929                    0.478
 2 LIkQgdMtovQ                0.02            0.788                    0.602
 3 LIkQgdMtovQ                0.03            0.718                    0.712
 4 LIkQgdMtovQ                0.04            0.718                    0.776
 5 LIkQgdMtovQ                0.05            0.706                    0.812
 6 LIkQgdMtovQ                0.06            0.718                    0.841
 7 LIkQgdMtovQ                0.07            0.694                    0.875
 8 LIkQgdMtovQ                0.08            0.718                    0.908
 9 LIkQgdMtovQ                0.09            0.776                    0.928
10 LIkQgdMtovQ                0.1             0.788                    0.936
# i 290 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 2.5 Transformasi Fungsi. The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 600 x 4
   vid_id      elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                    <dbl>                <dbl>                     <dbl>
 1 jytZgg-oQyM               0.01                0.986                     0.643
 2 jytZgg-oQyM               0.02                0.851                     0.763
 3 jytZgg-oQyM               0.03                0.865                     0.856
 4 jytZgg-oQyM               0.04                0.824                     0.902
 5 jytZgg-oQyM               0.05                0.838                     0.923
 6 jytZgg-oQyM               0.06                0.824                     0.933
 7 jytZgg-oQyM               0.07                0.878                     0.932
 8 jytZgg-oQyM               0.08                0.838                     0.922
 9 jytZgg-oQyM               0.09                0.824                     0.903
10 jytZgg-oQyM               0.1                 0.824                     0.881
# i 590 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 2.6 Kombinasi Beberapa Fungsi. The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 300 x 4
   vid_id      elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                    <dbl>                <dbl>                     <dbl>
 1 oKlJDBsc_A0               0.01                1.01                      0.747
 2 oKlJDBsc_A0               0.02                0.872                     0.835
 3 oKlJDBsc_A0               0.03                0.820                     0.893
 4 oKlJDBsc_A0               0.04                0.808                     0.910
 5 oKlJDBsc_A0               0.05                0.820                     0.914
 6 oKlJDBsc_A0               0.06                0.769                     0.914
 7 oKlJDBsc_A0               0.07                0.731                     0.913
 8 oKlJDBsc_A0               0.08                0.731                     0.912
 9 oKlJDBsc_A0               0.09                0.718                     0.909
10 oKlJDBsc_A0               0.1                 0.705                     0.904
# i 290 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 2.7 Fungsi Satu-Satu dan Inversnya. The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 500 x 4
   vid_id      elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                    <dbl>                <dbl>                     <dbl>
 1 hcUC4IFisL4              0.01                0.937                     0.700
 2 hcUC4IFisL4              0.02                0.747                     0.788
 3 hcUC4IFisL4              0.03                0.709                     0.850
 4 hcUC4IFisL4              0.04                0.709                     0.878
 5 hcUC4IFisL4              0.05                0.709                     0.895
 6 hcUC4IFisL4              0.06                0.722                     0.909
 7 hcUC4IFisL4              0.07                0.722                     0.918
 8 hcUC4IFisL4              0.08                0.709                     0.923
 9 hcUC4IFisL4              0.09                0.696                     0.927
10 hcUC4IFisL4              0.1                 0.760                     0.930
# i 490 more rows
# i abbreviated name: 1: relative_retention_performance
```

Combining subtopic data into one topic.

```
# A tibble: 3,100 x 5
   vid_id    elapsed_time_ratio audience_watch_ratio relative_retention_p~1  year
   <chr>                  <dbl>                <dbl>                  <dbl> <dbl>
 1 7g35w-s~                0.01                0.991                  0.696  2020
```

```
 2 7g35w-s~               0.02                0.894                   0.817  2020
 3 7g35w-s~               0.03                0.832                   0.905  2020
 4 7g35w-s~               0.04                0.858                   0.940  2020
 5 7g35w-s~               0.05                0.832                   0.949  2020
 6 7g35w-s~               0.06                0.858                   0.950  2020
 7 7g35w-s~               0.07                0.823                   0.950  2020
 8 7g35w-s~               0.08                0.832                   0.950  2020
 9 7g35w-s~               0.09                0.796                   0.950  2020
10 7g35w-s~               0.1                 0.832                   0.950  2020
# i 3,090 more rows
# i abbreviated name: 1: relative_retention_performance
```

1.1.2 2021

Retrieving audience retention data of videos from subtopic 2.1 Fungsi with `start_date`
2021-08-22 and `end_date` 2021-12-31. The data was retrieved on 7 January 2024. The code
used for retrieving data from Youtube Analytics and Reporting API were as follows.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 400 x 4
   vid_id      elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                    <dbl>                <dbl>                     <dbl>
 1 7g35w-sL_JA               0.01                 1.03                     0.721
 2 7g35w-sL_JA               0.02                 0.858                    0.825
 3 7g35w-sL_JA               0.03                 0.850                    0.901
 4 7g35w-sL_JA               0.04                 0.876                    0.933
 5 7g35w-sL_JA               0.05                 0.903                    0.946
 6 7g35w-sL_JA               0.06                 0.903                    0.950
 7 7g35w-sL_JA               0.07                 0.920                    0.950
 8 7g35w-sL_JA               0.08                 0.885                    0.950
 9 7g35w-sL_JA               0.09                 0.876                    0.950
10 7g35w-sL_JA               0.1                  0.850                    0.950
# i 390 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 2.2 Grafik Fungsi for the 2021.
The data was retrieved on 7 January 2024.

```
# A tibble: 600 x 4
   vid_id      elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                    <dbl>                <dbl>                     <dbl>
 1 aHo1kbccgLM               0.01                 1.01                     0.725
```

```
 2 aHo1kbccgLM            0.02              0.867                 0.832
 3 aHo1kbccgLM            0.03              0.876                 0.910
 4 aHo1kbccgLM            0.04              0.895                 0.940
 5 aHo1kbccgLM            0.05              0.943                 0.949
 6 aHo1kbccgLM            0.06              0.971                 0.950
 7 aHo1kbccgLM            0.07              1                     0.950
 8 aHo1kbccgLM            0.08              0.971                 0.950
 9 aHo1kbccgLM            0.09              1.01                  0.950
10 aHo1kbccgLM            0.1               0.924                 0.950
# i 590 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 2.3 Informasi Penting Grafik
Fungsi. The data was retrieved on 7 January 2024 from Youtube API Explorer with these
codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 400 x 4
   vid_id      elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                    <dbl>                <dbl>                     <dbl>
 1 MD5LDDmH3Lo               0.01              1                         0.773
 2 MD5LDDmH3Lo               0.02              0.884                     0.872
 3 MD5LDDmH3Lo               0.03              0.990                     0.934
 4 MD5LDDmH3Lo               0.04              0.958                     0.949
 5 MD5LDDmH3Lo               0.05              0.916                     0.951
 6 MD5LDDmH3Lo               0.06              0.905                     0.951
 7 MD5LDDmH3Lo               0.07              0.926                     0.951
 8 MD5LDDmH3Lo               0.08              0.916                     0.951
 9 MD5LDDmH3Lo               0.09              0.926                     0.951
10 MD5LDDmH3Lo               0.1               0.979                     0.951
# i 390 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 2.4 Fungsi Linear dan Model-
nya. The data was retrieved on 7 January 2024 from Youtube API Explorer with these
codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 300 x 4
   vid_id       elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                     <dbl>                <dbl>                     <dbl>
 1 LIkQgdMtovQ                0.01                1.05                      0.711
 2 LIkQgdMtovQ                0.02                0.920                     0.808
 3 LIkQgdMtovQ                0.03                0.875                     0.873
 4 LIkQgdMtovQ                0.04                0.807                     0.895
 5 LIkQgdMtovQ                0.05                0.818                     0.906
 6 LIkQgdMtovQ                0.06                0.807                     0.919
 7 LIkQgdMtovQ                0.07                0.807                     0.932
 8 LIkQgdMtovQ                0.08                0.852                     0.942
 9 LIkQgdMtovQ                0.09                0.886                     0.947
10 LIkQgdMtovQ                0.1                 0.920                     0.949
# i 290 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 2.5 Transformasi Fungsi. The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTimeR
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 600 x 4
   vid_id       elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                     <dbl>                <dbl>                     <dbl>
 1 jytZgg-oQyM                0.01                1.03                      0.676
 2 jytZgg-oQyM                0.02                1                         0.781
 3 jytZgg-oQyM                0.03                0.931                     0.852
 4 jytZgg-oQyM                0.04                0.861                     0.877
 5 jytZgg-oQyM                0.05                0.833                     0.888
 6 jytZgg-oQyM                0.06                0.875                     0.898
 7 jytZgg-oQyM                0.07                0.889                     0.905
 8 jytZgg-oQyM                0.08                0.875                     0.907
 9 jytZgg-oQyM                0.09                0.833                     0.908
10 jytZgg-oQyM                0.1                 0.889                     0.909
# i 590 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 2.6 Kombinasi Beberapa Fungsi. The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTimeR
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
```

```
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 300 x 4
   vid_id     elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                   <dbl>                <dbl>                     <dbl>
 1 oKlJDBsc_A0              0.01                0.956                     0.633
 2 oKlJDBsc_A0              0.02                0.769                     0.752
 3 oKlJDBsc_A0              0.03                0.736                     0.84
 4 oKlJDBsc_A0              0.04                0.802                     0.866
 5 oKlJDBsc_A0              0.05                0.758                     0.848
 6 oKlJDBsc_A0              0.06                0.714                     0.794
 7 oKlJDBsc_A0              0.07                0.659                     0.719
 8 oKlJDBsc_A0              0.08                0.681                     0.655
 9 oKlJDBsc_A0              0.09                0.648                     0.625
10 oKlJDBsc_A0              0.1                 0.615                     0.628
# i 290 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 2.7 Fungsi Satu-Satu dan Inversnya. The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 500 x 4
   vid_id     elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                   <dbl>                <dbl>                     <dbl>
 1 hcUC4IFisL4             0.01                0.908                     0.564
 2 hcUC4IFisL4             0.02                0.776                     0.694
 3 hcUC4IFisL4             0.03                0.710                     0.805
 4 hcUC4IFisL4             0.04                0.710                     0.871
 5 hcUC4IFisL4             0.05                0.763                     0.909
 6 hcUC4IFisL4             0.06                0.790                     0.928
 7 hcUC4IFisL4             0.07                0.790                     0.933
 8 hcUC4IFisL4             0.08                0.737                     0.931
 9 hcUC4IFisL4             0.09                0.710                     0.928
10 hcUC4IFisL4             0.1                 0.697                     0.928
# i 490 more rows
# i abbreviated name: 1: relative_retention_performance
```

Combining subtopic data into one topic.

```
# A tibble: 3,100 x 5
   vid_id   elapsed_time_ratio audience_watch_ratio relative_retention_p~1   year
   <chr>                 <dbl>                <dbl>                  <dbl>  <dbl>
 1 7g35w-s~               0.01                 1.03                  0.721   2021
 2 7g35w-s~               0.02                0.858                  0.825   2021
 3 7g35w-s~               0.03                0.850                  0.901   2021
 4 7g35w-s~               0.04                0.876                  0.933   2021
 5 7g35w-s~               0.05                0.903                  0.946   2021
 6 7g35w-s~               0.06                0.903                  0.950   2021
 7 7g35w-s~               0.07                0.920                  0.950   2021
 8 7g35w-s~               0.08                0.885                  0.950   2021
 9 7g35w-s~               0.09                0.876                  0.950   2021
10 7g35w-s~               0.1                 0.850                  0.950   2021
# i 3,090 more rows
# i abbreviated name: 1: relative_retention_performance
```

1.1.3 Two Year Data

```
retention_2 <- bind_rows(retention_2020_2,
                         retention_2021_2)

write_csv(retention_2,
          file = "datasets/retention_2.csv")

print(retention_2)
```

```
# A tibble: 6,200 x 5
   vid_id   elapsed_time_ratio audience_watch_ratio relative_retention_p~1   year
   <chr>                 <dbl>                <dbl>                  <dbl>  <dbl>
 1 7g35w-s~               0.01                0.991                  0.696   2020
 2 7g35w-s~               0.02                0.894                  0.817   2020
 3 7g35w-s~               0.03                0.832                  0.905   2020
 4 7g35w-s~               0.04                0.858                  0.940   2020
 5 7g35w-s~               0.05                0.832                  0.949   2020
 6 7g35w-s~               0.06                0.858                  0.950   2020
 7 7g35w-s~               0.07                0.823                  0.950   2020
 8 7g35w-s~               0.08                0.832                  0.950   2020
 9 7g35w-s~               0.09                0.796                  0.950   2020
10 7g35w-s~               0.1                 0.832                  0.950   2020
# i 6,190 more rows
# i abbreviated name: 1: relative_retention_performance
```

1.2 Rational Functions

1.2.1 2020

Retrieving audience retention data of videos from subtopic 3.1 Fungsi Rasional. The data
was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 300 x 4
   vid_id      elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                   <dbl>                <dbl>                     <dbl>
 1 fS8JmmjCg4Y              0.01                0.954                     0.660
 2 fS8JmmjCg4Y              0.02                0.853                     0.760
 3 fS8JmmjCg4Y              0.03                0.767                     0.823
 4 fS8JmmjCg4Y              0.04                0.705                     0.838
 5 fS8JmmjCg4Y              0.05                0.690                     0.842
 6 fS8JmmjCg4Y              0.06                0.667                     0.853
 7 fS8JmmjCg4Y              0.07                0.659                     0.869
 8 fS8JmmjCg4Y              0.08                0.690                     0.884
 9 fS8JmmjCg4Y              0.09                0.674                     0.897
10 fS8JmmjCg4Y              0.1                 0.643                     0.908
# i 290 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 3.2 Grafik Fungsi Rasional. The
data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 400 x 4
   vid_id      elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                   <dbl>                <dbl>                     <dbl>
 1 7Ji0rZA-D7k              0.01                1.01                      0.725
 2 7Ji0rZA-D7k              0.02                0.817                     0.821
 3 7Ji0rZA-D7k              0.03                0.742                     0.888
 4 7Ji0rZA-D7k              0.04                0.656                     0.910
 5 7Ji0rZA-D7k              0.05                0.688                     0.916
 6 7Ji0rZA-D7k              0.06                0.667                     0.919
 7 7Ji0rZA-D7k              0.07                0.570                     0.921
```

```
 8 7Ji0rZA-D7k              0.08              0.570                     0.923
 9 7Ji0rZA-D7k              0.09              0.645                     0.926
10 7Ji0rZA-D7k              0.1               0.634                     0.930
# i 390 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 3.3 Pertidaksamaan Rasional.
The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTimeⓍ
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 200 x 4
   vid_id      elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                    <dbl>                <dbl>                     <dbl>
 1 quoIHoqCJs4               0.01                0.966                     0.772
 2 quoIHoqCJs4               0.02                0.864                     0.867
 3 quoIHoqCJs4               0.03                0.864                     0.925
 4 quoIHoqCJs4               0.04                0.796                     0.938
 5 quoIHoqCJs4               0.05                0.739                     0.940
 6 quoIHoqCJs4               0.06                0.716                     0.940
 7 quoIHoqCJs4               0.07                0.693                     0.940
 8 quoIHoqCJs4               0.08                0.648                     0.939
 9 quoIHoqCJs4               0.09                0.693                     0.935
10 quoIHoqCJs4               0.1                 0.682                     0.928
# i 190 more rows
# i abbreviated name: 1: relative_retention_performance
```

Combining subtopics into one topic data.

```
# A tibble: 900 x 5
   vid_id   elapsed_time_ratio audience_watch_ratio relative_retention_p~1  year
   <chr>                 <dbl>                <dbl>                  <dbl> <dbl>
 1 fS8Jmmj~               0.01                0.954                  0.660  2020
 2 fS8Jmmj~               0.02                0.853                  0.760  2020
 3 fS8Jmmj~               0.03                0.767                  0.823  2020
 4 fS8Jmmj~               0.04                0.705                  0.838  2020
 5 fS8Jmmj~               0.05                0.690                  0.842  2020
 6 fS8Jmmj~               0.06                0.667                  0.853  2020
 7 fS8Jmmj~               0.07                0.659                  0.869  2020
 8 fS8Jmmj~               0.08                0.690                  0.884  2020
 9 fS8Jmmj~               0.09                0.674                  0.897  2020
10 fS8Jmmj~               0.1                 0.643                  0.908  2020
# i 890 more rows
# i abbreviated name: 1: relative_retention_performance
```

1.2.2 2021

Retrieving audience retention data of videos from subtopic 3.1 Fungsi Rasional. The data
was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 300 x 4
   vid_id       elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                    <dbl>                <dbl>                     <dbl>
 1 fS8JmmjCg4Y               0.01                0.971                     0.674
 2 fS8JmmjCg4Y               0.02                0.754                     0.771
 3 fS8JmmjCg4Y               0.03                0.696                     0.845
 4 fS8JmmjCg4Y               0.04                0.659                     0.885
 5 fS8JmmjCg4Y               0.05                0.630                     0.913
 6 fS8JmmjCg4Y               0.06                0.659                     0.931
 7 fS8JmmjCg4Y               0.07                0.681                     0.940
 8 fS8JmmjCg4Y               0.08                0.652                     0.944
 9 fS8JmmjCg4Y               0.09                0.674                     0.944
10 fS8JmmjCg4Y               0.1                 0.725                     0.943
# i 290 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 3.2 Grafik Fungsi Rasional. The
data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 400 x 4
   vid_id       elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                    <dbl>                <dbl>                     <dbl>
 1 7Ji0rZA-D7k               0.01                0.966                     0.749
 2 7Ji0rZA-D7k               0.02                0.716                     0.837
 3 7Ji0rZA-D7k               0.03                0.716                     0.896
 4 7Ji0rZA-D7k               0.04                0.636                     0.915
 5 7Ji0rZA-D7k               0.05                0.557                     0.918
 6 7Ji0rZA-D7k               0.06                0.557                     0.919
 7 7Ji0rZA-D7k               0.07                0.568                     0.921
 8 7Ji0rZA-D7k               0.08                0.557                     0.924
 9 7Ji0rZA-D7k               0.09                0.523                     0.927
```

```
10 7Ji0rZA-D7k              0.1               0.546                 0.930
# i 390 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 3.3 Pertidaksamaan Rasional.
The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTimeR
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 200 x 4
   vid_id     elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                   <dbl>                <dbl>                     <dbl>
 1 quoIHoqCJs4              0.01                0.971                     0.762
 2 quoIHoqCJs4              0.02                0.714                     0.865
 3 quoIHoqCJs4              0.03                0.657                     0.931
 4 quoIHoqCJs4              0.04                0.757                     0.948
 5 quoIHoqCJs4              0.05                0.714                     0.950
 6 quoIHoqCJs4              0.06                0.7                       0.947
 7 quoIHoqCJs4              0.07                0.7                       0.938
 8 quoIHoqCJs4              0.08                0.671                     0.919
 9 quoIHoqCJs4              0.09                0.614                     0.896
10 quoIHoqCJs4              0.1                 0.614                     0.885
# i 190 more rows
# i abbreviated name: 1: relative_retention_performance
```

Combining subtopics into one topic data.

```
# A tibble: 900 x 5
   vid_id    elapsed_time_ratio audience_watch_ratio relative_retention_p~1  year
   <chr>                  <dbl>                <dbl>                  <dbl> <dbl>
 1 fS8Jmmj~                0.01                0.971                  0.674  2021
 2 fS8Jmmj~                0.02                0.754                  0.771  2021
 3 fS8Jmmj~                0.03                0.696                  0.845  2021
 4 fS8Jmmj~                0.04                0.659                  0.885  2021
 5 fS8Jmmj~                0.05                0.630                  0.913  2021
 6 fS8Jmmj~                0.06                0.659                  0.931  2021
 7 fS8Jmmj~                0.07                0.681                  0.940  2021
 8 fS8Jmmj~                0.08                0.652                  0.944  2021
 9 fS8Jmmj~                0.09                0.674                  0.944  2021
10 fS8Jmmj~                0.1                 0.725                  0.943  2021
# i 890 more rows
# i abbreviated name: 1: relative_retention_performance
```

1.2.3 Two Year Data

```r
retention_3 <- bind_rows(retention_2020_3,
                         retention_2021_3)

write_csv(retention_3,
          file = "datasets/retention_2.csv")

print(retention_3)
```

```
# A tibble: 1,800 x 5
   vid_id     elapsed_time_ratio audience_watch_ratio relative_retention_p~1   year
   <chr>                   <dbl>                <dbl>                  <dbl>  <dbl>
 1 fS8Jmmj~                 0.01                0.954                  0.660   2020
 2 fS8Jmmj~                 0.02                0.853                  0.760   2020
 3 fS8Jmmj~                 0.03                0.767                  0.823   2020
 4 fS8Jmmj~                 0.04                0.705                  0.838   2020
 5 fS8Jmmj~                 0.05                0.690                  0.842   2020
 6 fS8Jmmj~                 0.06                0.667                  0.853   2020
 7 fS8Jmmj~                 0.07                0.659                  0.869   2020
 8 fS8Jmmj~                 0.08                0.690                  0.884   2020
 9 fS8Jmmj~                 0.09                0.674                  0.897   2020
10 fS8Jmmj~                 0.1                 0.643                  0.908   2020
# i 1,790 more rows
# i abbreviated name: 1: relative_retention_performance
```

1.3 Exponential and Logarithmic Functions

1.3.1 2020

Retrieving audience retention data of videos from subtopic 4.1 Fungsi Eksponen. The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 300 x 4
  vid_id      elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
  <chr>                    <dbl>                <dbl>                     <dbl>
1 zG5DYRKRrRI               0.01                 1.01                     0.666
2 zG5DYRKRrRI               0.02                 0.876                    0.754
3 zG5DYRKRrRI               0.03                 0.876                    0.814
4 zG5DYRKRrRI               0.04                 0.804                    0.838
5 zG5DYRKRrRI               0.05                 0.825                    0.853
```

```
 6 zG5DYRKRrRI            0.06            0.814                  0.866
 7 zG5DYRKRrRI            0.07            0.814                  0.878
 8 zG5DYRKRrRI            0.08            0.835                  0.887
 9 zG5DYRKRrRI            0.09            0.825                  0.894
10 zG5DYRKRrRI            0.1             0.835                  0.900
# i 290 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 4.2 Fungsi Eksponen Alami.
The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 200 x 4
   vid_id       elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                     <dbl>                <dbl>                     <dbl>
 1 s-HX0NcVGco                0.01                0.902                     0.684
 2 s-HX0NcVGco                0.02                0.761                     0.796
 3 s-HX0NcVGco                0.03                0.696                     0.882
 4 s-HX0NcVGco                0.04                0.685                     0.921
 5 s-HX0NcVGco                0.05                0.728                     0.939
 6 s-HX0NcVGco                0.06                0.706                     0.947
 7 s-HX0NcVGco                0.07                0.728                     0.949
 8 s-HX0NcVGco                0.08                0.728                     0.950
 9 s-HX0NcVGco                0.09                0.663                     0.95
10 s-HX0NcVGco                0.1                 0.706                     0.95
# i 190 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 4.3 Fungsi Logaritma. The
data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 400 x 4
   vid_id       elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                     <dbl>                <dbl>                     <dbl>
 1 wjQracmCEag                0.01                0.933                     0.458
 2 wjQracmCEag                0.02                0.733                     0.595
```

```
 3 wjQracmCEag              0.03              0.717                    0.733
 4 wjQracmCEag              0.04              0.717                    0.831
 5 wjQracmCEag              0.05              0.717                    0.888
 6 wjQracmCEag              0.06              0.667                    0.914
 7 wjQracmCEag              0.07              0.717                    0.925
 8 wjQracmCEag              0.08              0.733                    0.930
 9 wjQracmCEag              0.09              0.7                      0.933
10 wjQracmCEag              0.1               0.75                     0.933
# i 390 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 4.4 Sifat-Sifat Logaritma. The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 300 x 4
   vid_id       elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                     <dbl>                <dbl>                     <dbl>
 1 WnE0II00EQ0                0.01                 1.03                      0.602
 2 WnE0II00EQ0                0.02                 0.871                     0.678
 3 WnE0II00EQ0                0.03                 0.790                     0.715
 4 WnE0II00EQ0                0.04                 0.758                     0.703
 5 WnE0II00EQ0                0.05                 0.694                     0.675
 6 WnE0II00EQ0                0.06                 0.742                     0.649
 7 WnE0II00EQ0                0.07                 0.742                     0.635
 8 WnE0II00EQ0                0.08                 0.726                     0.638
 9 WnE0II00EQ0                0.09                 0.742                     0.658
10 WnE0II00EQ0                0.1                  0.726                     0.687
# i 290 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 4.5 Persamaan-Persamaan Eksponen dan Logaritma. The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 200 x 4
   vid_id     elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                   <dbl>                <dbl>                     <dbl>
 1 gcx2CLY3GD4              0.01                1.01                      0.746
 2 gcx2CLY3GD4              0.02                0.714                     0.837
 3 gcx2CLY3GD4              0.03                0.636                     0.891
 4 gcx2CLY3GD4              0.04                0.662                     0.896
 5 gcx2CLY3GD4              0.05                0.649                     0.884
 6 gcx2CLY3GD4              0.06                0.649                     0.870
 7 gcx2CLY3GD4              0.07                0.649                     0.867
 8 gcx2CLY3GD4              0.08                0.662                     0.879
 9 gcx2CLY3GD4              0.09                0.623                     0.900
10 gcx2CLY3GD4              0.1                 0.636                     0.921
# i 190 more rows
# i abbreviated name: 1: relative_retention_performance
```

Combining subtopics into one topic data.

```
# A tibble: 1,400 x 5
   vid_id   elapsed_time_ratio audience_watch_ratio relative_retention_p~1  year
   <chr>                 <dbl>                <dbl>                  <dbl> <dbl>
 1 zG5DYRK~              0.01                1.01                    0.666  2020
 2 zG5DYRK~              0.02                0.876                   0.754  2020
 3 zG5DYRK~              0.03                0.876                   0.814  2020
 4 zG5DYRK~              0.04                0.804                   0.838  2020
 5 zG5DYRK~              0.05                0.825                   0.853  2020
 6 zG5DYRK~              0.06                0.814                   0.866  2020
 7 zG5DYRK~              0.07                0.814                   0.878  2020
 8 zG5DYRK~              0.08                0.835                   0.887  2020
 9 zG5DYRK~              0.09                0.825                   0.894  2020
10 zG5DYRK~              0.1                 0.835                   0.900  2020
# i 1,390 more rows
# i abbreviated name: 1: relative_retention_performance
```

1.3.2 2021

Retrieving audience retention data of videos from subtopic 4.1 Fungsi Eksponen. The
data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 300 x 4
   vid_id     elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
```

```
    <chr>               <dbl>            <dbl>             <dbl>
 1 zG5DYRKRrRI          0.01             0.989             0.677
 2 zG5DYRKRrRI          0.02             0.956             0.747
 3 zG5DYRKRrRI          0.03             0.833             0.791
 4 zG5DYRKRrRI          0.04             0.8               0.805
 5 zG5DYRKRrRI          0.05             0.767             0.810
 6 zG5DYRKRrRI          0.06             0.756             0.810
 7 zG5DYRKRrRI          0.07             0.733             0.802
 8 zG5DYRKRrRI          0.08             0.711             0.792
 9 zG5DYRKRrRI          0.09             0.744             0.790
10 zG5DYRKRrRI          0.1              0.711             0.797
# i 290 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 4.2 Fungsi Eksponen Alami.
The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 200 x 4
   vid_id       elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>               <dbl>            <dbl>             <dbl>
 1 s-HX0NcVGco         0.01             0.974             0.626
 2 s-HX0NcVGco         0.02             0.769             0.733
 3 s-HX0NcVGco         0.03             0.731             0.82
 4 s-HX0NcVGco         0.04             0.756             0.873
 5 s-HX0NcVGco         0.05             0.705             0.909
 6 s-HX0NcVGco         0.06             0.808             0.931
 7 s-HX0NcVGco         0.07             0.795             0.944
 8 s-HX0NcVGco         0.08             0.795             0.949
 9 s-HX0NcVGco         0.09             0.782             0.950
10 s-HX0NcVGco         0.1              0.756             0.950
# i 190 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 4.3 Fungsi Logaritma. The
data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 400 x 4
   vid_id      elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                    <dbl>                <dbl>                     <dbl>
 1 wjQracmCEag               0.01                0.933                     0.458
 2 wjQracmCEag               0.02                0.733                     0.595
 3 wjQracmCEag               0.03                0.717                     0.733
 4 wjQracmCEag               0.04                0.717                     0.831
 5 wjQracmCEag               0.05                0.717                     0.888
 6 wjQracmCEag               0.06                0.667                     0.914
 7 wjQracmCEag               0.07                0.717                     0.925
 8 wjQracmCEag               0.08                0.733                     0.930
 9 wjQracmCEag               0.09                0.7                       0.933
10 wjQracmCEag               0.1                 0.75                      0.933
# i 390 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 4.4 Sifat-Sifat Logaritma. The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
  --header 'Accept: application/json' \
  --compressed
```

```
# A tibble: 300 x 4
   vid_id      elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
   <chr>                    <dbl>                <dbl>                     <dbl>
 1 WnE0II00EQ0               0.01                1.03                      0.602
 2 WnE0II00EQ0               0.02                0.871                     0.678
 3 WnE0II00EQ0               0.03                0.790                     0.715
 4 WnE0II00EQ0               0.04                0.758                     0.703
 5 WnE0II00EQ0               0.05                0.694                     0.675
 6 WnE0II00EQ0               0.06                0.742                     0.649
 7 WnE0II00EQ0               0.07                0.742                     0.635
 8 WnE0II00EQ0               0.08                0.726                     0.638
 9 WnE0II00EQ0               0.09                0.742                     0.658
10 WnE0II00EQ0               0.1                 0.726                     0.687
# i 290 more rows
# i abbreviated name: 1: relative_retention_performance
```

Retrieving audience retention data of videos from subtopic 4.5 Persamaan-Persamaan Eksponen dan Logaritma. The data was retrieved on 7 January 2024 from Youtube API Explorer with these codes.

```
curl \
  'https://youtubeanalytics.googleapis.com/v2/reports?dimensions=video%2CelapsedVideoTime
  --header 'Authorization: Bearer [YOUR_ACCESS_TOKEN]' \
```

```
    --header 'Accept: application/json' \
    --compressed


# A tibble: 200 x 4
    vid_id      elapsed_time_ratio audience_watch_ratio relative_retention_perf~1
    <chr>                    <dbl>                <dbl>                     <dbl>
 1 gcx2CLY3GD4               0.01                 1.01                      0.746
 2 gcx2CLY3GD4               0.02                 0.714                     0.837
 3 gcx2CLY3GD4               0.03                 0.636                     0.891
 4 gcx2CLY3GD4               0.04                 0.662                     0.896
 5 gcx2CLY3GD4               0.05                 0.649                     0.884
 6 gcx2CLY3GD4               0.06                 0.649                     0.870
 7 gcx2CLY3GD4               0.07                 0.649                     0.867
 8 gcx2CLY3GD4               0.08                 0.662                     0.879
 9 gcx2CLY3GD4               0.09                 0.623                     0.900
10 gcx2CLY3GD4               0.1                  0.636                     0.921
# i 190 more rows
# i abbreviated name: 1: relative_retention_performance
```

Combining subtopics into one topic data.

```
# A tibble: 1,400 x 5
    vid_id   elapsed_time_ratio audience_watch_ratio relative_retention_p~1   year
    <chr>                 <dbl>                <dbl>                  <dbl>  <dbl>
 1 zG5DYRK~               0.01                 1.01                   0.666   2020
 2 zG5DYRK~               0.02                 0.876                  0.754   2020
 3 zG5DYRK~               0.03                 0.876                  0.814   2020
 4 zG5DYRK~               0.04                 0.804                  0.838   2020
 5 zG5DYRK~               0.05                 0.825                  0.853   2020
 6 zG5DYRK~               0.06                 0.814                  0.866   2020
 7 zG5DYRK~               0.07                 0.814                  0.878   2020
 8 zG5DYRK~               0.08                 0.835                  0.887   2020
 9 zG5DYRK~               0.09                 0.825                  0.894   2020
10 zG5DYRK~               0.1                  0.835                  0.900   2020
# i 1,390 more rows
# i abbreviated name: 1: relative_retention_performance
```