Question 1

(1).

(4 - (-4)) / 32 = 0.25

(1.8 + 3.75)/0.25 = 22

(2.2 + 3.75)/0.25 = 24 ……

22, 24, 24, 28, 28, 28, 25, 26, 26, 26, 21, 19, 20, 20, 22, 24, 24, 24, 23, 24, 20, 16, 10, 10, 8, 11, 6, 9, 9, 12, 15, 19

(2).

32 = 2^5

5 * 32 = 160

We need 160 bits to transmit it.

Question 2

(1).

Y U V 4:2:0

4 * 12 + 12 + 12 = 72 bits per 4 pixels

72 / 4 = 18 bits per pixel

1920 * 1080 * 18 * 24 = 895795200 = 111.97 Mbytes per second

Disk write with a varying disk write speed (12 to 36 Mbytes per second)

B_out/B_in = 12/111.97 = 0.107

(2).

352 * 288 * 18 * 24 = 43794432 = 5.47 Mbytes per second

File size smaller than 12 Mbytes, no compression needed.

Ratio can be 1.

(3).

1920:1080 = 16:9 = square pixel(1:1)

352:288 = 11: 9 = width:height

16/9 ÷ 11/9 = 1/1 ÷ width/height

width/height = 11/16

The original square pixel is stretched from 1:1 to 11:16.

Pixel aspect ratio = 11/16 = 0.6875

Question 3

(1).

36km/h = 3600m/h = 10m/s

diameter = 0.4244

perimeter = pi*diameter = 0.4244pi

10m/s ÷ 0.4244pi = 7.5 rotations/sec

24 > 2*7.5, no aliasing effect. The rate of tire rotation is 7.5 rotations/sec.

(2).

7.5*360 = 2700 total degree in 1 second

2700 / 8 = 337.5 degree per frame

337.5 – 360 = -22.5 speed difference

-22.5 * 8 = -180 degree difference per second

-180 / 360 = -0.5 rotations/sec

Rotate backward in 0.5 rotations/sec.

(3).

Desired rate of rotation = 12 rotations/sec

180km/h = 50m/s

50m/s ÷ perimeter = 12 rotations/sec

Perimeter = 50/12 = pi*diameter

Diameter = 1.33m