

1. Determine the density altitude for these conditions:

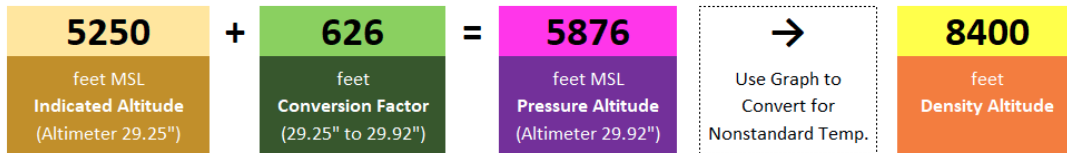
Altimeter setting 29.25 "Hg  
 Runway temperature +81 °F  
 Airport elevation 5,250 feet MSL

The choices on the exam are:

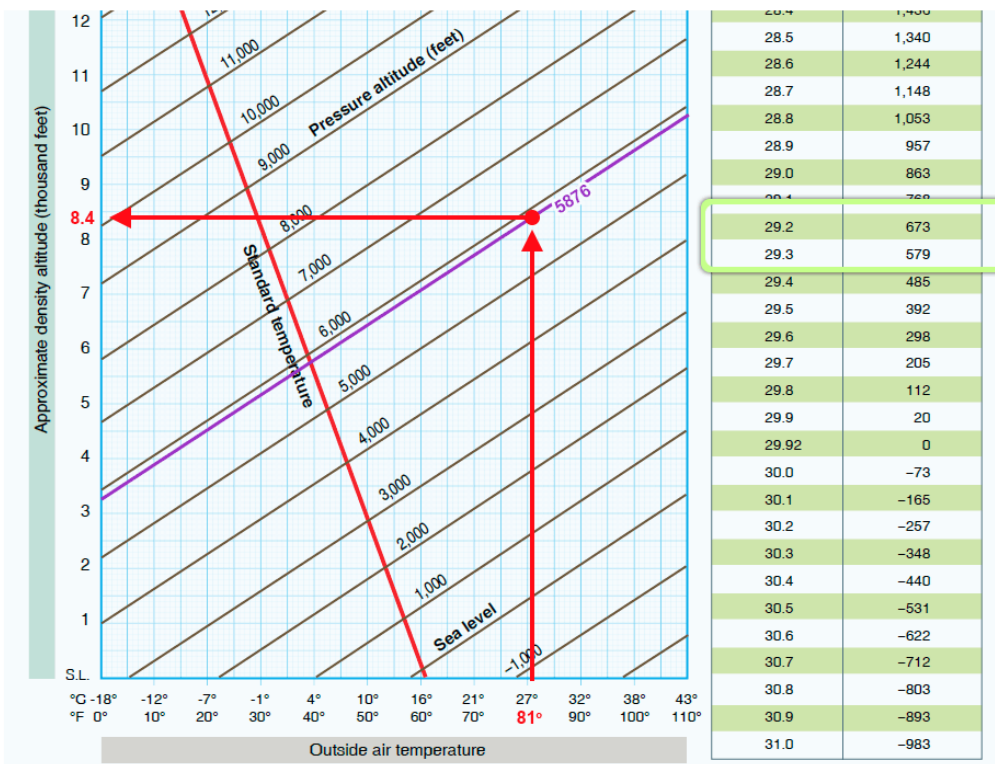
- A: 8,500 feet MSL
- B: 5,877 feet MSL
- C: 4,600 feet MSL

The answer closest to correct is A: 8,500 feet

- Determine the Pressure Altitude conversion factor by looking at the list on the right side of the figure. We determine the pressure altitude conversion factor for an altimeter setting of 29.25 by interpolating (in this case, taking the average) of the conversion factors for 29.2 and 29.3, giving us a value of 626.
- We add 626 to the airport elevation of 5250 to get a pressure altitude of 5876.
- We find the spot on the table where 81F from the temperature scale intersects 5876 on the diagonal pressure altitude scale.
- Looking from this point to the density altitude scale, we see that the density altitude is 8400 MSL.



This example is of a hot day with a pressure setting that increases the density altitude further. Aircraft performance on such days is often quite poor.



To Solve for 29.25, Interpolate as follows:

1. Note the (absolute) difference in pressure altitude conversion factor from 29.2 to 29.3 is 673 - 579 = 94
2. 29.25 is halfway between 29.2 and 29.3. Therefore, interpolation which assumes a linear relationship is easy. Just take the average of 673 and 579, or, to put it another way, add half of 94 to the lower value of 579. Half of 94 is 47, and 579 + 47 = 626

Add the 5250' airport elevation to our 626' pressure altitude conversion factor to get a pressure altitude of 5876'.

2. What is the effect of a temperature increase from 30 °F to 50 °F on the density altitude if the pressure altitude remains at 3,000 feet MSL?

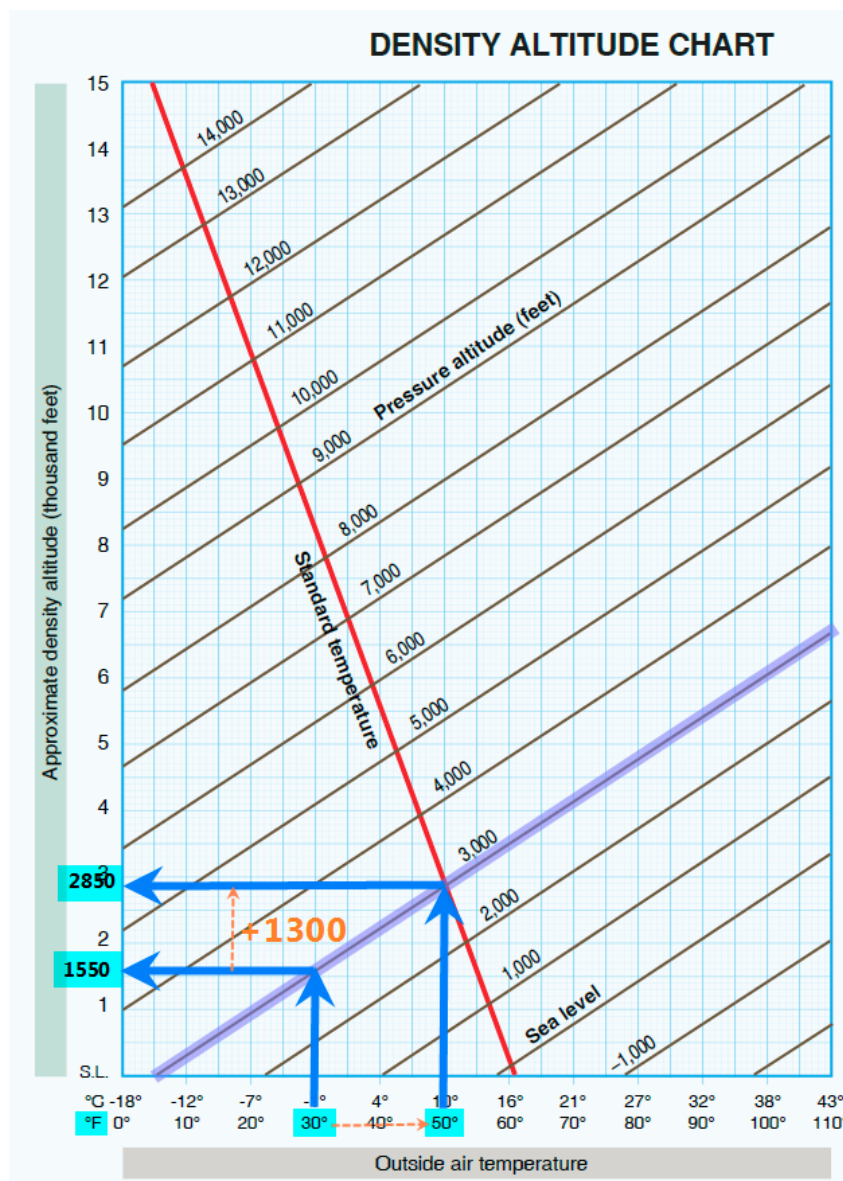
The choices on the exam are:

- A: 1,000 foot increase
- B: 1,100 foot increase
- C: 1,300 foot increase

The answer closest to correct is C: 1,300 foot increase

- Enter the density altitude chart at 30°F. Proceed up to the 3,000-foot pressure altitude line. From the point of intersection, move left to read a density altitude of 1,550 feet.
- Enter the density altitude chart at 50°F. Proceed up to the 3,000-foot pressure altitude line. From the point of intersection, move left to read a density altitude of 2,850 feet.
- Find the difference between the two values:  $2,850 - 1,550 = 1,300$  foot (increase).

If you see such questions from the FAA, always choose the closest answer from the answer choices provided as the graphs are sometimes inaccurate and subject to individual measurement differences.



3. Determine the maximum total wind velocity for a 45° crosswind if the maximum crosswind component for the airplane is 25 knots.

The choices on the exam are:

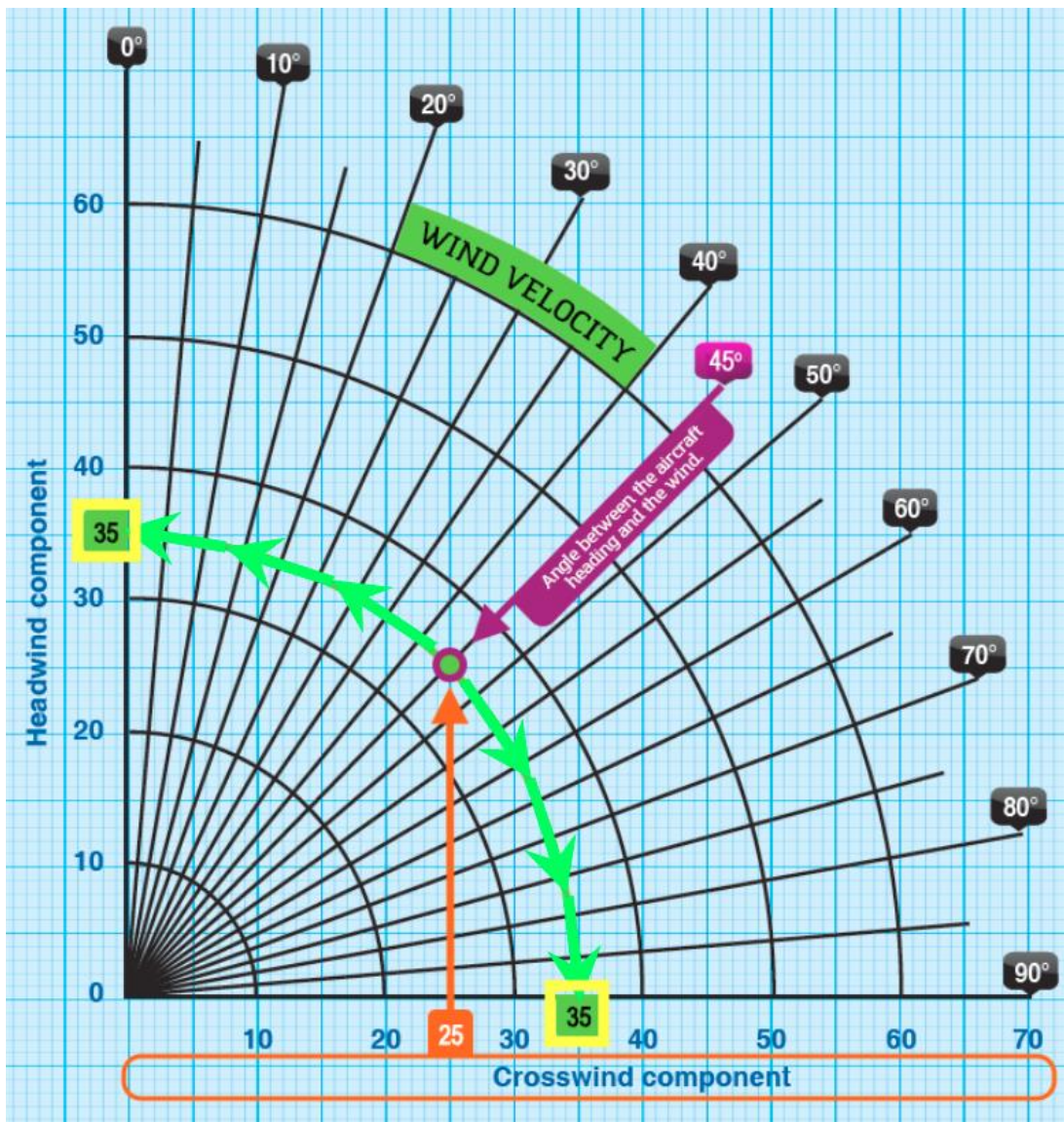
- A: 29 knots
- B: 35 knots
- C: 25 knots

The answer closest to correct is B: 35 knots

- Start at the bottom at the 25 knot crosswind and go up until the 45 degree line.
- Read 35 knots (green wind velocity arc line) for the wind velocity.
- **35 knots** is the best answer.

Correct/Incorrect Answers:

- 35 knots is the correct answer because the question is asking about maximum wind velocity. It is important that you recognize that wind velocity is plotted in concentric quarter circles from the origin. You can read either "left" or right along the arc to read 35 knots - it doesn't matter which way you go.
- 25 knots is incorrect. You would get "25 knots" if you read "across" to the "headwind component" axis, but this is not what the question is asking about.
- 29 knots is just a nonsense answer, likewise incorrect.



4. What is the headwind component for a landing on Runway 18 if the tower reports the wind as 220° at 30 knots?

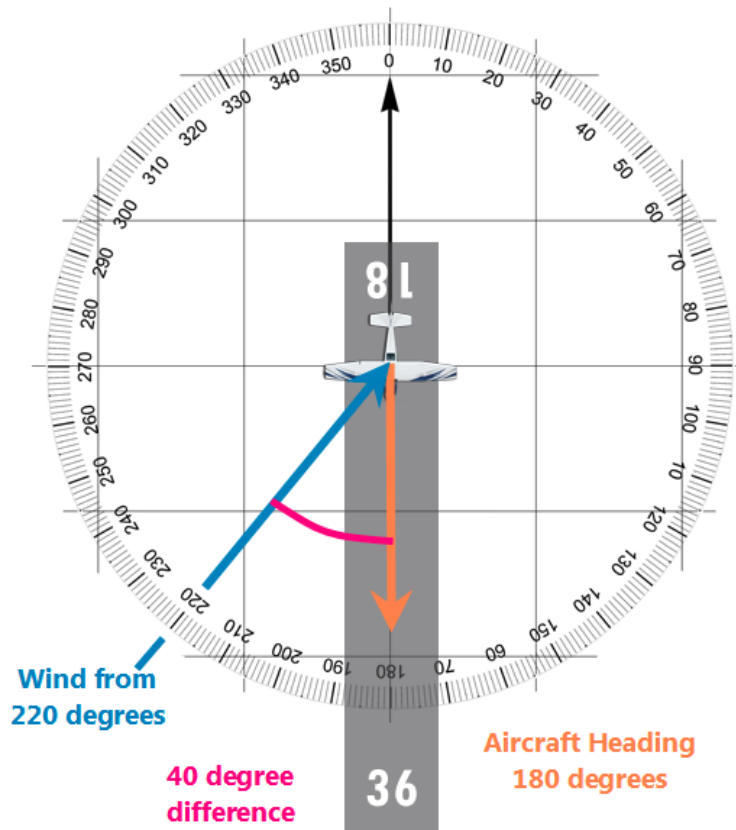
The choices on the exam are:

- A: 23 knots
- B: 19 knots
- C: 26 knots

The answer closest to correct is A: 23 knots

- If the aircraft is on (landing on) Runway 18, then the (approximate) magnetic heading of the aircraft is 180.
- If the tower reports the wind as 220 degrees, then the wind is FROM 220 degrees

Drawing this out, we see that the wind is coming 40 degrees off the nose to the right.



Now let's use the wind chart provided to determine the headwind and crosswind components.

- Follow the 40 degree line down until it meets the 30 knot arc (green line)
- Go DOWN to read crosswind component of 19 knots
- **Go left to read headwind component of 23 knots**



5. Determine the total distance required to land over a 50 foot obstacle.

Pressure altitude: 3,750 feet

Headwind: 12 knots

Temperature: standard

The choices on the exam are:

A: 794 feet

B: 816 feet

C: 836 feet

The answer closest to correct is B: 816 feet

		Landing distance								Flaps lowered to 40° – Power off Hard surface runway – Zero wind	
Gross weight lb	Approach speed, IAS, MPH	At sea level & 59 °F		At 2,500 feet & 50 °F		At 5,000 feet & 41 °F		At 7,500 feet & 32 °F			
		Ground roll	Total to clear 50 feet OBS	Ground roll	Total to clear 50 feet OBS	Ground roll	Total to clear 50 feet OBS	Ground roll	Total to clear 50 feet OBS		
1,600	60	445	1,075	470	1,135	495	1,195	520	1,255		

NOTE: 1. Decrease the distances shown by 10% for each 4 knots of headwind.  
2. Increase the distance by 10% for each 60 °F temperature increase above standard.  
3. For operation on a dry, grass runway, increase distance (both "ground roll" and "total to clear 50 feet obstacle") by 20% of the "total to clear 50 feet obstacle" figure.

1. First, determine the TOTAL TO CLEAR a 50' OBSTACLE for 3750 feet.

- We are given data in the figure only for 2500 and 5000 feet. So, to find a value for 3750 feet, we must interpolate.
- Fortunately, 3750 is directly between 2500 and 5000, so we can take a simple average.
- Given that we're looking at the "to land over a 50 foot obstacle" values, we get an average by adding 1135 and 1195 and dividing the sum by 2 = 1165.

2. Then, correct for the headwind per Note 1

- Note 1 tells us to decrease the distance 10% for each 4 knots of headwind. This implies about a 30% decrease (for you mathematical types worrying about the language--the '10%' are additive--this is NOT compound interest we are talking about here).
- $1165 * (1 - .3) = 815.5 = \mathbf{816 \text{ feet.}}$

1. First interpolate between 1,135 and 1,195 to determine a non-wind corrected landing distance of 1,165 feet for a pressure altitude of 3750'.

		Landing distance								Flaps lowered to 40° – Power off Hard surface runway – Zero wind	
Gross weight lb	Approach speed, IAS, MPH	At sea level & 59 °F		At 2,500 feet & 50 °F		At 5,000 feet & 41 °F		At 7,500 feet & 32 °F			
		Ground roll	Total to clear 50 feet OBS	Ground roll	Total to clear 50 feet OBS	Ground roll	Total to clear 50 feet OBS	Ground roll	Total to clear 50 feet OBS		
1,600	60	445	1,075	470	1,135	495	1,195	520	1,255		

NOTE: 1. Decrease the distances shown by 10% for each 4 knots of headwind  
2. Increase the distance by 10% for each 60 °F temperature increase above standard.  
3. For operation on a dry, grass runway, increase distance (both "ground roll" and "total to clear 50 feet obstacle") by 20% of the "total to clear 50 feet obstacle" figure.

2. Then, per Note 1, correct the distance for the 12 knot headwind. We need to decrease the 1,165 foot uncorrected distance by 30%.

$1,165 \text{ feet} \times 0.7 = \mathbf{816 \text{ feet}}$

6. Determine the total distance required to land.  
 OAT: 32 °F  
 Pressure altitude: 8,000 feet  
 Weight: 2,600 lbs  
 Headwind component: 20 knots  
 Obstacle: 50 feet

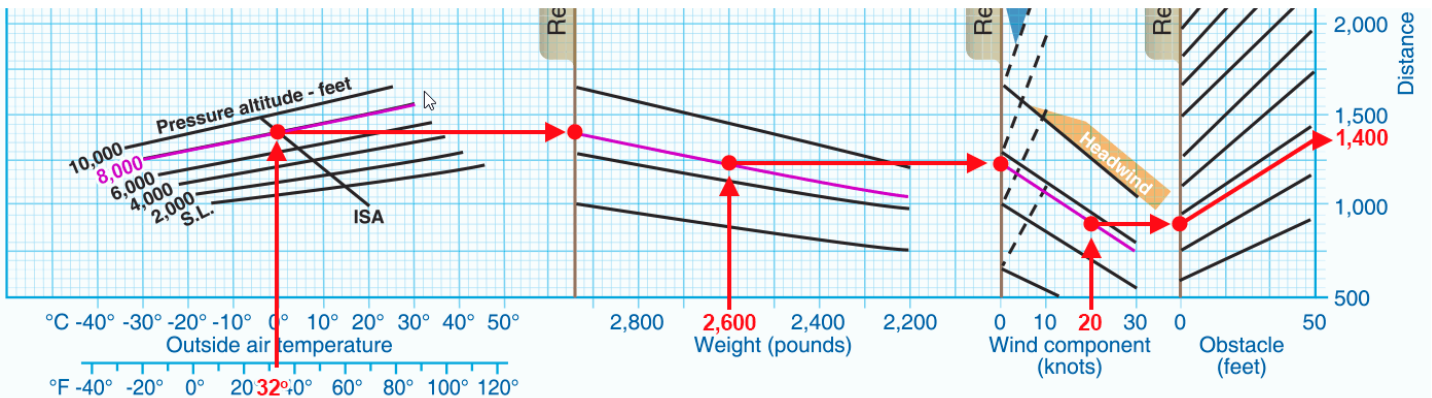
The choices on the exam are:

- A: 1,750 feet
- B: 850 feet
- C: 1,400 feet

The answer closest to correct is C: 1,400 feet

Look at the Figure.

1. Convert 32F to 0C using the conversion scale and find 0C OAT on the OAT scale.
2. Find the place where 0C OAT intersects the 8000' pressure altitude line
3. Move horizontally from that point to **the reference line**.
4. Draw a line roughly parallel to the three diagonal lines beginning with your point on the reference line.
5. Find the point where the line intersects the given weight of 2600 lbs.
6. Move horizontally from that point to the **second reference line**.
7. Draw a line parallel to the 3 or 4 headwind lines, again, starting from where our horizontal line intersects the second reference line.
8. Find the spot where the line intersects our headwind component of 20 knots.
9. Go horizontally to the **third reference line**.
10. As our obstacle is 50 feet high, draw a line roughly parallel to the multiple diagonal obstacle height lines there, again, starting at the reference line.
11. This should lead you to an indication of roughly 1400 feet on the rightmost axis.



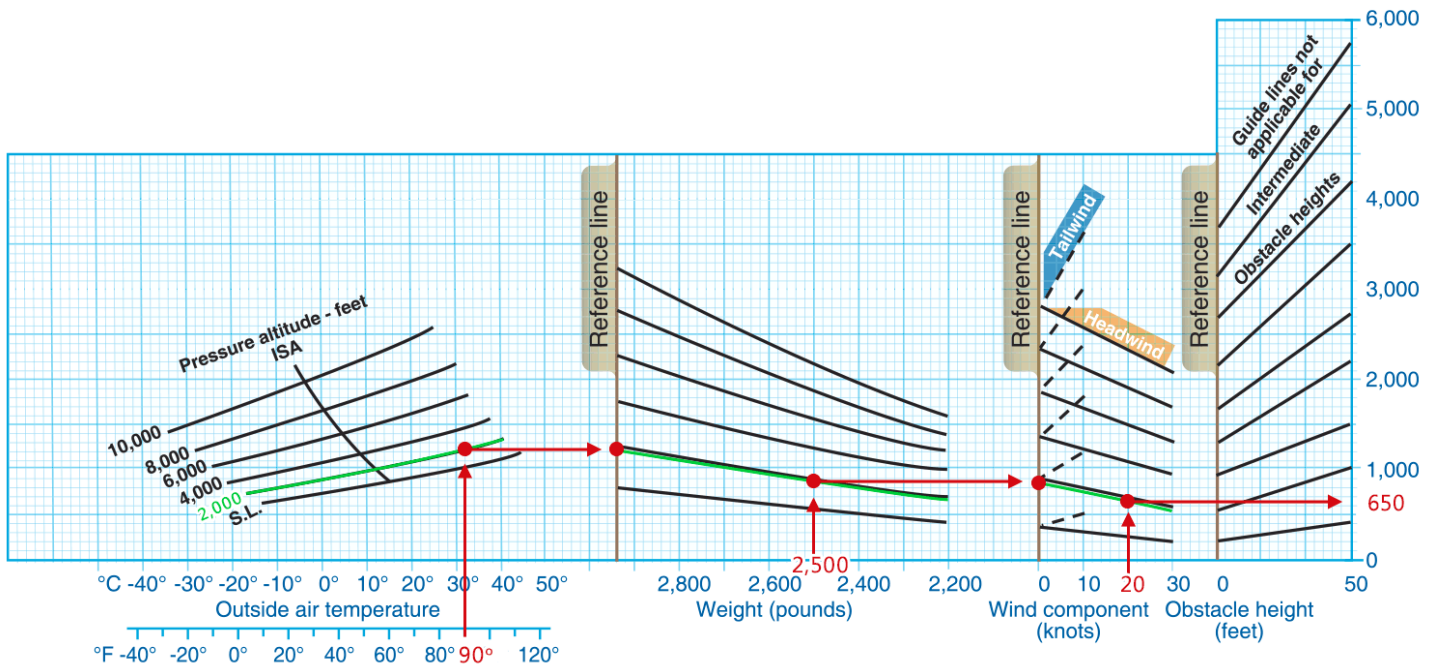
7. Determine the approximate ground roll distance required for takeoff.  
 OAT: 90 °F  
 Pressure altitude: 2,000 feet  
 Takeoff weight: 2,500 lb  
 Headwind component: 20 knots

The choices on the exam are:

- A: 650 feet
- B: 850 feet
- C: 1,000 feet

The answer closest to correct is: A: 650 feet

1. Enter the chart from the bottom at 90 degrees F, read up to the 2000 ft line.
2. Go right to the reference line.
3. Parallel the lines down to where the 2,500lb line intersects
4. Go right to the 2nd reference line
5. Parallel the lines down to where the 20KT line intersects
6. Go right to read 650'.



8. What true airspeed should a pilot expect with 65 percent maximum continuous power at 9,500 feet with a temperature of 36 °F below standard?

The choices on the exam are:

- A: 183 mph
- B: 178mph
- C: 181 mph

The answer closest to correct is: A: 183 mph

Cruise power settings  
65% Maximum continuous power (or full throttle 2,800 pounds)

Press ALT.	ISA -20 °C (-36 °F)								Standard day (ISA)								ISA +20 °C (+36 °F)										
	IOAT		Engine speed	MAN. press		Fuel flow per engine		TAS		IOAT		Engine speed	MAN. press		Fuel flow per engine		TAS		IOAT		Engine speed	MAN. press		Fuel flow per engine		TAS	
	°F	°C	RPM	IN HG	PSI	GPH	KTS	MPH	°F	°C	RPM	IN HG	PSI	GPH	KTS	MPH	°F	°C	RPM	IN HG	PSI	GPH	KTS	MPH			
SL	27	-3	2,450	20.7	6.6	11.5	147	169	63	17	2,450	21.2	6.6	11.5	150	173	99	37	2,450	21.8	6.6	11.5	153	176			
2,000	19	-7	2,450	20.4	6.6	11.5	149	171	55	13	2,450	21.0	6.6	11.5	153	176	91	33	2,450	21.5	6.6	11.5	156	180			
4,000	12	-11	2,450	20.1	6.6	11.5	152	175	48	9	2,450	20.7	6.6	11.5	156	180	84	29	2,450	21.3	6.6	11.5	159	183			
6,000	5	-15	2,450	19.8	6.6	11.5	155	178	41	5	2,450	20.4	6.6	11.5	158	182	79	26	2,450	21.0	6.6	11.5	161	185			
8,000	-2	-19	2,450	19.5	6.6	11.5	157	181	36	2	2,450	20.2	6.6	11.5	161	185	72	22	2,450	20.8	6.6	11.5	164	189			
10,000	-8	-22	2,450	19.2	6.6	11.5	160	184	28	-2	2,450	19.9	6.6	11.5	163	188	64	18	2,450	20.3	6.5	11.4	166	191			
12,000	-15	-26	2,450	18.8	6.4	11.5	162	186	21	-6	2,450	18.8	6.1	10.9	163	188	57	14	2,450	18.8	5.9	10.6	163	188			
14,000	-22	-30	2,450	17.4	5.8	10.5	159	183	14	-10	2,450	17.4	5.6	10.1	160	184	50	10	2,450	17.4	5.4	9.8	160	184			
16,000	-29	-34	2,450	16.1	5.3	9.7	156	180	7	-14	2,450	16.1	5.1	9.4	156	180	43	6	2,450	16.1	4.9	9.1	155	178			

Note: 1. Full throttle manifold pressure settings are approximate.  
2. Shaded area represents operation with full throttle.

Note that the answer choices are given in MPH (Miles Per Hour) so we will be looking in the MPH True Airspeed (TAS) column rather than in the KTS (Knots - Nautical Miles per Hour) columns.

- Enter the chart in the left area (ISA -20C [-36F])
- Read the True Airspeed value for 8000 (181 MPH) and 10,000 (184 MPH)
- At this point, you know the answer must be between 181 and 184 MPH but can't be exactly either of those (since 9,500 is more than 8,000 and less than 10,000). From this, you can correctly conclude that, from the answer choices, 183 MPH must be the correct answer, which it is. However, you can also interpolate (do the math) to calculate this exactly if you like.
- Interpolate to arrive at 183.25 MPH. The closest answer is 183 MPH.

Temperature 36F Below Standard (ISA -36F)

Press ALT.	ISA -20 °C (-36 °F)								
	IOAT		Engine speed	MAN. press		Fuel flow per engine		TAS	
	°F	°C	RPM	IN HG	PSI	GPH	KTS	MPH	
SL	27	-3	2,450	20.7	6.6	11.5	147	169	
2,000	19	-7	2,450	20.4	6.6	11.5	149	171	
4,000	12	-11	2,450	20.1	6.6	11.5	152	175	
6,000	5	-15	2,450	19.8	6.6	11.5	155	178	
8,000	-2	-19	2,450	19.5	6.6	11.5	157	181	
10,000	-8	-22	2,450	19.2	6.6	11.5	160	184	
12,000	-15	-26	2,450	18.8	6.4	11.5	162	186	
14,000	-22	-30	2,450	17.4	5.8	10.5	159	183	
16,000	-29	-34	2,450	16.1	5.3	9.7	156	180	

To Solve for 9500', Interpolate as follows:

1. Note the difference between 8000' and 10000' is 2000'.
2. Look at the relevant MPH column. Note the difference between 184 and 181 is 3 MPH. Therefore, assuming a linear relationship for this segment, 3 MPH here corresponds to 2000'.
3. If 3 MPH corresponds to 2000', then 1000' corresponds to 1.5 MPH and 500' corresponds to .75 MPH, and, correspondingly, 1500' corresponds to 2.25 MPH.
4. Add 2.25 MPH to our 181 MPH value for 8000' to arrive at an answer of 183.25 MPH for 9500'.

We need to solve for 9500' PA